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Oilcrops Research Network

Proceedings of a Steering Committee Meeting and Workshop *held in* ***Nairobi, Kenya*** ***August 11-14, 1992***

Edited by
Luis A. Navarro

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April 26, 1995

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Foreword

Annual oilcrops such as sunflower, sesame, rapeseed, and others are important sources of edible oils and protein-rich presscake in most of the poor countries of Africa and Asia that are deficient in fat intake. Consistently, however, these crops have underperformed in terms of both their potential production of coproducts and their potential contribution to employment, income, foreign exchange savings/gains, and, particularly, improved nutrition among the poor.

Partly compensating for the international neglect of these crops, IDRC began supporting research in oilcrops in the early 1980s, with attention to the fifteen countries in Africa and the five in South Asia that display the lowest per-capita intakes of fats and oils and some of the severest malnutrition problems in the world.

In 1992, as part of its general reorganization and reprogramming, IDRC was in the process of formulating a more effective mode of continuing its support to the generally neglected oilcrops research field. As part of this process, IDRC facilitated an Oilcrops Research Network (ORN) Steering Committee meeting and workshop held from 11-14 August 1992 at the Safari Park Hotel in Nairobi.

This report contains the main presentations that fed into the deliberations as well as the outcomes of the workshop. Initially, due to resource constraints, these proceedings were not to be published. At this date, however, responding to many requests from participants in the workshop and members of the former network, IDRC recovered the workshop material and put it at the disposal of scientists in the oilcrops field in the form of this report. Only two workshop presentations are missing here: "The Other Oilcrops Subnetwork," by Dr. B. El-Ahmar, and "The FAO Rural Oil Processing Project in Kenya," by Mr. I. Kibuthu.

IDRC expects this report will help to renew the interest and efforts of those committed to research in the oilcrops field to find other ways and means of continuing the Oilcrops Research Network, as agreed during the workshop. Presently, IDRC is supporting the establishment phase of the Vegetable Oils and Protein Systems Improvement Network (VOPSIN) in Eastern Africa. Contact persons are Dr. S. Chema, Project Leader, and Mr. O. Schmidt, Network Coordinator. They may be contacted at AGREF, P. O. Box 39189, Nairobi, Kenya (Phone: 254-2-443752, Fax: 254-2-228006, E-mail on INTERNET: agref@elci.gn.apc.org).

As usual, this work is the result of the contributions of many, foremost the workshop participants, including the authors featured here. Mr. O. Schmidt and Dr. A. Omran were instrumental in the task of recovering the material. Efficient secretarial support was provided by Ms. Francesca Odero and Ms. Hilda Khadija. Form and English editing were the contribution of Ms. Lisa Lawley.

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Senior Programme Specialist
IDRC-Nairobi
April 26, 1995

Executive Summary

IDRC-Oilcrops Research Network Steering Committee Meeting and Workshop, 11-14 August 1992, Nairobi, Kenya

In 1992, the International Development Research Centre (IDRC) was in the process of formulating a more effective mode for continuing its support to research in the generally neglected oilcrops research field, which includes the development of a stronger partnership with other international agencies and donors. As part of this process, IDRC facilitated an Oilcrops Research Network (ORN) Steering Committee Meeting and Workshop held from11-14 August 1992 in Nairobi. Participants were members of the Steering Committee (SC) of the ORN, representatives from national oilcrops research programmes (NORPs), international agencies, and donors—a total of forty-two people.

The workshop was designed to

- be an open forum/opportunity for network representatives to review progress and outcomes of the ORN's activities and decide the future of the network;
- permit IDRC, in light of the changes in focus and style that it was then defining, to present its own position in relation to intended future support for research in oilcrops, internalizing its previous experience of supporting a series of oilcrops-related bilateral projects and the ORN; and
- arrive at an initial idea of a potentially feasible scenario for the overall network structure, behaviour, and expected performance in the future—and suggestions for followup discussions and actions.

Inputs for the deliberations were 1) the review/reports by the SC on the ORN's evolution, achievements, and projections; 2) cases of other interventions to study or improve the performance of the oilcrops sector; 3) a report on a recent evaluation of the ORN commissioned by IDRC; 4) a report on an IDRC in-house study that draws on the centre's own account of past expectations and perceptions of opportunities manifested by concerned decision makers, researchers, and donors surveyed in Africa and Asia; and 5) the position of IDRC and other donors vis-à-vis their support for improving the performance of the oilcrops sector in developing countries, now and in the future.

Network Evolution and Achievements

Breeding and improved cultural practices in the main oilcrops and also in the more traditional oilcrops were the focus of the research fostered by the ORN and provided new options to the regions covered by the network.

The *Brassica*, Sunflower, Sesame, and Other Oilcrops subnetworks have made significant progress and have provided clear benefits in terms of improved technologies, new varieties, and advancement of training leading to potentially faster development of the sector's production in several participating countries. Other indirect benefits, harder to quantify, also were acknowledged. The clearest, and probably the most important, outcome, however, has been the development of a corps of trained and motivated researchers who constitute the network. These researchers have just begun to produce work that reflects the outputs and benefits of interaction and collaborative research.

The ORN evaluation report indicates that the activities of the network have been scrutinized in detail and in depth. IDRC can derive satisfaction from the report's conclusion that the network's achievements indeed have justified the centre's investment. The network undoubtedly has achieved its original objectives. Continued pressures and the progress so far in developing the corps of network researchers and their organization, however, suggest the need for a revision of the original networking objectives and their evolution into concrete outputs and outcomes as new objectives for future network(s). The agreement was that these outputs and outcomes should be defined in terms of benefits to the final target beneficiaries—producers and consumers of limited resources and economic means—and in terms of improved nutrition.

Other Interventions in the Sector

The ORN has considered oilcrops primarily from the perspective of edible-oil production. In discussing cases of other interventions in the sector, however, the need and opportunity to consider other uses of oilcrops and other dimensions of the sector's performance was acknowledged. There is a growing market for vegetable oils tailored to meet the needs of the chemicals industry, for example. Other considerations include the livestock and poultry industries' growing demand for protein-rich meal, which in many settings is becoming more important than the demand for edible oil.

To discover new perspectives on the utilization of oilcrops, and also new perspectives and attractive priorities for oilcrops research, requires a wider knowledge and understanding of the sector as a whole. This wider knowledge and understanding was crucial to the identification of research as well as other interventions aimed at improving the performance of the oilcrops sector in cases presented to the workshop from India, Kenya, and Nepal. The usefulness of the production-to- consumption systems (PCS) concept and its application in this context was also acknowledged in the different cases. IDRC has been supporting the development and use of the PCS approach to guide research and other interventions in Kenya's oilcrops sector since 1988 and has followed suit, more recently, in Zambia and Tanzania. (The PCS concept was presented to the ORN during meetings in India and Cairo during 1989 and at Egerton University in Kenya in 1991.)

The special study presented by Dr. Riley during the workshop suggests a scenario in which the ORN could be helped to grow and evolve to become more effective and responsive to the special needs of specific regions and conditions. Three regional subnetworks—West Asia and North Africa (WANA), South East Asia and China, and Eastern Africa—were suggested. These subnetworks would use the production-to-consumption systems research (PCSR) approach to identify the research priorities and related interventions that will help improve the performance of the oilcrops sector in the countries of each region. This approach would entail a broader-based network membership in which breeding and agronomy research is complemented by research in other disciplines; research and interventions of other sorts, including policy adjustments, also would complement each other. The PCSR approach finally may entail identification and activation of a "sector committee" or broad-based body of concerned and influential people in each focal country who lobby and catalyze positive actions and collaboration within the sector (e.g., the Canola Council in Canada and a similar group that is being formed in China).

The IDRC Position

IDRC's discovery in 1980 that support for oilcrops research was very necessary in East Africa and South Asia identified a real need. The people of many of the countries in these and neighbouring regions were—and by and large continue to be—undersupplied with edible oils/fats; their consumption remains very low to low. Today, IDRC is highly satisfied with the ORN's progress in this sector and with the return provided on its support.

In view of changing conditions and its new mandate, however, IDRC could no longer continue supporting the network as it had. Its interest had grown beyond simply improving and sustaining overall edible oil/protein production to include income and employment for the people who consume far less than they need of these foodstuffs, foreign exchange savings/gains for the countries, and improved nutrition among the neediest people who participate in the sector.

Future of the Network

Based on input from special meetings called during the workshop, the ORN Steering Committee took on the challenge of addressing the changes the network faced. The SC participated actively in the final discussions and provided a concrete plan of action for a transition period, for which it requested only minimal support from IDRC.

The ORN acknowledged that in order to bring research, extension, social, market, and nutrition considerations into play, a production-to-consumption systems-type view and approach must be adopted. Case studies presented to the workshop demonstrated the value of such an approach, and the SC discussed and endorsed a recommendation that the next phase of the network follow along these lines. At the time, however, given the new position of IDRC and the minimal representation of other donors, it still was unclear how the regional programmes could be initiated, organized, and funded. The SC also noted that not only in East Africa but in the countries of Southern Africa, the needs were most pressing.

Thus the need to continue the network also was acknowledged and a preferred approach to the future generally agreed upon—one that would

- stress a PCSR-type guiding and monitoring approach;
- encourage closer horizontal cooperation between NORPs;
- dovetail with other international, regional, and bilateral programmes;
- stress attention to the ultimate beneficiaries: small farmers and low-income groups;
- add a strong outreach component through extension and informal means such as NGOs and community groups;
- encourage more initiative from the interested countries; and
- define projects more clearly and monitor and evaluate them periodically.

Participants in the meeting also generally agreed that future projects should be proposed in modules along regional lines or on the basis of relevant topics, e.g., closing major gaps in germplasm collections or making village-level oil extractors available. Such modules should be presented to various potential donors for possible adoption and support.

Finally, the SC provided a proposal for immediate action that includes a request for restricted financial and logistical support from IDRC. This proposal was further discussed, considering the new and real restrictions in the IDRC. The International Development Research Centre agreed to respond to the SC proposal within two weeks. This response, which was sent to all workshop participants on schedule, is also included in this report.

Welcome Address

☼

Sarwat Salem

for

Pierre Sane, Regional Director, IDRC/Nairobi

IDRC has sponsored research and networking in oilcrops for more than a decade. This demonstrates the Centre's acknowledgment of the importance of these crops for the final beneficiaries of IDRC's work: poor people in developing countries, particularly those in arid and semiarid environments.

IDRC's commitment to fostering development and the well-being of the poor in developing countries continues today and has grown stronger. The experience of many years, however, has suggested the necessity for a constant review of procedures and approaches to the centre's task. As part of such a review process, IDRC is presently undergoing changes, or adjustments, that we want our partners to be aware of in order to discuss them and find ways of continuing our fruitful collaboration as part of a common task. Some of the changes are structural, some are of style, and some involve focus.

As an example, consider briefly the changes that are shaping up in the East and Southern African Regional Office of IDRC: The regional office used to be responsible for developing programmes that were centrally led from Ottawa; today, the regional office has the responsibility of defining and developing its own programmes in direct response to regional priorities. Presently, the East and Southern African Regional Office is shaping up five regional programmes. These are

- Sustainable Use of Natural Resources

- Productive Employment

- Community Health
- Regional Integration
- Education.

These regional programmes will interact with global thrusts defined within the divisions of Environment and Natural Resources, Information Sciences and Systems, Social Sciences, and Health Sciences, with leadership from Ottawa. During this week, most probably you will learn more about the Environment and Natural Resources Division and also about the Information Sciences and Systems Division, both represented in the workshop.

Furthermore, the undergoing changes have prompted IDRC to look closely to some of its longstanding efforts, such as those in oilcrops research. In this case, IDRC has provided for an evaluation of the Oilseeds Research Network and a special survey/study of researchers and users of oilcrops research to discover desirable new directions.

With the reports from these studies as inputs into this workshop, IDRC wants to provide a stage for the discussion of oilcrops research and its networking by the actors themselves—the researchers—enabling them to address past achievements and experiences and, most importantly, the feasible and desirable future of this research and its networking. As another input, IDRC has invited presentations from participants in other efforts to improve the performance of the oilcrops sector. Finally, representatives of the donor community who, together with IDRC, have been invited to provide additional inputs for the deliberations.

IDRC's regional director, Dr. Pierre Sane, regrets that he is not able to be present to participate in this important workshop. He is presently ill. However, he sends his greetings, welcoming you all to Nairobi and to this workshop, and wishes you success in the deliberations. IDRC and other donors—those present and those who have sent regrets—will be looking forward to the results of these deliberations.

Section 1

Network Reports

1.1
Brief Review of the Sesame Subnetwork

S. Thangavelu
Chairman, Sesame Subnetwork

Edible oilseeds rank second in importance among food crops after cereals. Most edible oilseeds, however—with the exception of groundnut, soybean, and sunflower—have been largely neglected by the international research institutes and the scientific community. The oilcrops sesame, sunflower, niger, castor, and linseed receive little attention from developed or developing countries. Yet these neglected oilseeds are key crops for millions of small-scale farming families in developing countries.

A total of 6.6 million ha is under sesame cultivation worldwide, with average productivity in the vicinity of 360 kg/ha—a very low figure compared to the potential yield of 2,500 kg/ha.

For these reasons, IDRC decided to support sesame research programmes in some major sesame-growing countries. Besides research funding, IDRC considered technical support in the form of information supply, training, scientific visits, organization of workshops and seminars, and exchange of seed materials to be necessary inputs in the promotion of ongoing research programmes.

Achievements

In this regard, IDRC has devoted considerable effort to supporting national programmes in India, Sri Lanka, Pakistan, Egypt, Ethiopia, Sudan, Tanzania, Malawi, and Mozambique. IDRC has also established an effective and practical liaison between IDRC oilseeds projects in India, Pakistan, Eastern Africa, Egypt, Sudan, Ethiopia, and Sri Lanka.

Workshops

A first workshop was held in Cairo, Egypt, from 3-8 September 1983, for the sesame project leaders. The participants established a good flow of ideas and reached agreement about the exchange of germplasm. This helped the scientists to pursue their research programmes vigorously.

Similar workshops subsequently were held in Hyderabad, India, in February 1985; in Addis Ababa, Ethiopia, during October 1986; in Nairobi, Kenya, from 25-29 January 1988; and in Shanghai, China, from 5-10 July 1991.

Sesame Subnetwork

The sesame subnetwork was formed in January 1988. Its major achievements are as follows:

- Priority research areas were identified for major sesame-growing countries.
- Shoot webber was identified as by far the most serious pest.
- Information on major sesame pests and their control was compiled and is being made available to scientists.
- A bibliography of literature on sesame diseases was compiled and published.
- Research programmes were assigned to different countries based on priority and feasibility, and fruitful results were obtained.
- The subnetwork paved the way for the exchange of scientists between countries.
- Information was exchanged by way of an oilcrops newsletter, and the network provided the tropical oilseeds abstract to countries that requested it.

- A number of papers on the status of sesame production in different countries and research papers were presented. Resource scientists presented several keynote addresses.

- Approximately 183 germplasm types received were multiplied and supplied to participating countries, establishing a mechanism for free flow of germplasm among subnetwork countries.

- Information accruing from the achievements of IDRC-funded projects and national programmes was shared via subnetwork meetings and exchanges of scientists. As an example of this type of exchange, the screening methodology developed in India for shoot webber was easily adopted by other countries confronted with this problem.

- The research priorities identified also helped determine project funding. The programmes developing screening methodologies for phyllody, development of male sterility, etc., have therefore been assisted.

- Training programmes on sesame production and protection were conducted in India in 1983 and in 1991 for the benefit of scientists from participating countries.

- A Sudanese scientist received three months of in-service training in India, qualifying him to serve as project leader in Sudan.

- A Somali scientist qualified for a postgraduate degree in India, and additional study helped him to become the sesame project leader in Somalia.

- Research programmes to develop varieties with high yield potential and built-in resistance/tolerance to pests and diseases are now in progress in several countries.

The Sesame Subnetwork of the Oilcrops Research Network thus has been highly useful to the participating countries working to increase sesame productivity and production, especially for the small farmers of developing countries.

Constraints

Participation in the network by scientists from sesame-growing countries was restricted due to limited resources, since only one donor was providing funds. In addition, the chairman/cochairmen could not effectively monitor the action plans drawn up for the participating countries.

Strategy for the Future

The network should consist of all major sesame-growing countries that have good governmental support. The participation of all these countries will enhance the value of the network.

The establishment of an international institute for sesame research would be very helpful in improving the germplasm and research programmes, serving as a nodal agency as such institutes have done for other crops. Germplasm should flow freely between countries. Urgent steps should be taken to avoid losing the valuable germplasm available in various countries by taking up appropriate explorations and genetic conservation measures.

Specialized training on different aspects of research (i.e., breeding, agronomy, entomology, etc.) would be highly useful. The scientists involved in research activities should be involved in network activities.

Finally, to be more functional and achieve more, the network should be a multidonor-funded programme with proper monitoring.

1.2

Brassica Subnetwork Progress Report

Basudeo Singh

Chairman, *Brassica* Subnetwork

The International Development Research Centre (IDRC), Canada, started the Oilcrops Research Network in 1981. The main objective was to link IDRC-funded oilcrops research projects (ORPs) in Eastern Africa and South Asia to promote a steady flow of information, plant material, ideas, and experiences through an oilcrops newsletter, meetings, workshops, and project exchange visits.

In the third meeting of the Oilcrops Research Network held in Addis Ababa, Ethiopia, in October 1986, Dr. Geoffrey Hawtin, associate director, agriculture, food and nutrition sciences, IDRC, raised a number of issues in his inaugural speech: Is the geographical and crop coverage too wide? Would it be better to concentrate on fewer countries and/or fewer crops? Perhaps more focused subnetworks could be considered. . . . He further observed that it might be desirable to include crops such as *Brassica*, on which much research work has been done, together with relatively underdeveloped crops such as niger, sesame, and linseed.

In view of Dr. Hawtin's observations/remarks, the workshop recommended holding a special *Brassica* meeting. This meeting, ultimately organized by IDRC and the Swedish University of Agricultural Sciences at Uppsala, was held in Sweden from 6-7 May 1987, just prior to the 7th International Rapeseed Congress in Poznan, Poland, enabling participants to attend both meetings.

Twelve network members from six countries of South Asia and Africa attended the special *Brassica* meeting. Scientists from Canada and Sweden also attended the meeting as guest members. During the meeting, the *Brassica* Subnetwork was formed, with China, India, Nepal, Pakistan, Bangladesh, Bhutan, and Ethiopia as members and

Canada and Sweden as guest members. The meeting considered the constraints to production and possible collaborations. Germplasm exchange, information exchange, collaborative research, meetings/workshops, training, and review of papers on important aspects of *Brassica* production were planned as major activities.

Achievements

Germplasm Exchange

Member countries exchanged sixty-nine germplasm specimens of various species of cultivated *Brassica* oilcrops. India and China exchanged fifteen germplasm samples.

Meetings and Workshops

Four workshops were organized. The first *Brassica* Subnetwork workshop, held in Sweden in May 1987, was attended by twelve scientists. Additional workshops and meetings were held in Pantnagar, India, in January 1989; in Shanghai, China, in April 1990; and in Saskatoon, Canada, in July 1991.

Information Exchange

Information exchange took place between member countries through their articles in oilcrops newsletters, computer profiles compiled by the network advisor, exchange visits between projects, field visits after training sessions, and correspondence between members.

Publications

On the recommendation of the workshop participants, the following four review papers/technical bulletins were written by members for publication and circulation among scientists of member countries and others interested in *Brassica* research:

- "Screening and Breeding Techniques for Aphid Resistance in *Brassica* Oilcrops" (Dr. Basudeo Singh and Dr. D. R. C. Bakhetia)

- "Screening and Breeding Techniques for *Alternaria* Resistance in *Brassica* Oilcrops" (Dr. Basudeo Singh and Dr. S. J. Kolte)

- "Screening and Breeding Techniques for Drought Resistance in *Brassica* Oilcrops" (Dr. A. Kumar and J. N. Sadan)

- "Technical Bulletin on Diseases and Insect Pests of Brassica Oilcrops" (Dr. S. J. Kolte, Dr. G. C. Sachauand, and Dr. D. R. C. Bakhetia).

Training

Three kinds of training were organized at the request of subnetwork members:

Group Training

Training in research methodology for *Brassica* breeding and agronomy was held at Pantnagar, India, from 4-29 December 1989. Seventeen scientists from eight countries attended. Additional group training in *Brassica*-quality laboratory analysis was held in Shanghai, China, from 21-22 April 1990, with twenty-five scientists from six countries attending. Research methodology in *Brassica* plant protection was the subject of a group training session held at Pantnagar, India, from 3-30 December 1990. Ten scientists from five countries participated in this final session.

Individual Training

One technician from the Ethiopia Highland Oilcrops project and one from the Oilseeds Nepal project received full-crop-season training at Pantnagar, India, in 1988 and 1989.

Degree Training

One project staff member from the national oilcrops research project of Nepal completed a M.Sc. degree in plant pathology, and another scientist is pursuing an M.Sc. degree in plant breeding at Pantnagar in India.

Collaborative Research Project

India and Canada initiated collaborative projects on *Alternaria* blight and white rush management, quality breeding, and heterosis breeding in *Brassica juncea* and *B. caupesins*. Similarly, China and Canada initiated collaborative research projects on quality breeding and heterosis breeding.

1.3
The Progress of Rapeseed Production in China and the Role of the Oilcrops Research Network

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Zhang Yan
Shanghai Municipal Agriculture Commission, People's Republic of China

Since 1978, China has opened the door to the world. The Chinese government has given farmers great encouragement to expand their rapeseed production through various techniques. The purchase price of rapeseed has been increased several times. The sown area, total output, and yield per unit area of rapeseed were 467 million ha, 640.8 million tons, and 1,372.2 kg/ha respectively in 1990 (see Table 1.3.1). Rapeseed has become the most important oilcrop in China. Rapeseed alone comprises one-third of the country's total oilcrops output and 40 to 50 percent of the total edible vegetable oil.

Table 1.3.1: Rapeseed Production in China

Year	Sown Area (10,000 ha)	Total Output (10,000 tons)	Yield (kg/ha)
1981	380.1	406.5	1,069.5
1982	412.2	565.6	1,372.1
1983	366.9	428.7	1,168.4
1984	341.3	420.5	1,232.1
1985	449.4	560.7	1,247.7
1986	491.6	588.1	1,196.3
1987	526.7	660.5	1,260.0
1988	493.6	504.4	1,020.0
1989	533.0	540.0	1,013.0
1990	467.0	640.8	1,372.2

Quality Rapeseed Breeding in China

The high-quality rapeseed breeding programme, which the government initiated in the late 1970s, has been included in the sixth, seventh, and eighth five-year plans' key projects of the State Agricultural Plan. Since 1983, the Canadian IDRC has aided the Institute of Oil Crops Research (IOCR) of the Chinese Academy of Agricultural Sciences, Shanghai Academy of Agricultural Sciences (SAAS), Qinghai Academy of Agriculture and Forestry (QAAF), and Xinjiang Academy of Agricultural Sciences (XAAS) in the breeding of high-quality rapeseed. Up to now, nine single-low cultivars, three double-low cultivars, and a number of new lines with high seed yield, good quality, and wide adaptability have been developed. Their basic qualities are given in Table 1.3.2.

Table 1.3.2: High-quality Rapeseed Cultivars Bred by IOCR, SAAS, QAAF, and XAAS

Cultivar	Selector	Quality*	Oil Content(%)	Released in
B. napus	IORC	0+	42.0	1986
Zhongyou Dijie No. 1	IORC	0+	42.0	1986
Zhongyou Dijie No. 2	IORC	0+	41.0	1986
Zhongyou Dijie No. 3	SAAS	0+	41.0	1990
Shenyouqing	QAAF	0+	44.7	1991
Dandi	IORC	00	42.0	1990
Zhongshuang No. 1	IORC	00	43.0	1990
Zhongshuang No. 2				
B. campestris	QAAF	0+	42.6	1989
Qingyou No. 11	QAAF	0+	41.1	1989
Qingyou No. 13	QAAF	0+	39.8	1990
Qingyou No. 15				
B. juncea	XAAS	0+	37.9	1989
Xinyou No. 4	XAAS	0+	37.7	1989
Xinyou No. 5				

*0+ = low erucic acid; 00 = low erucic acid and low glucosinolate

Besides the cultivars listed in Table 1.3.2, more than twenty others have been released by other provincial institutions. The total area covered by these new cultivars is more than 500,000 ha.

Study and Utilization of Rapeseed Heterosis

China began study of heterosis of F_1 rapeseed hybrids in the early 1940s. The yield of the hybrids tested in SAAS in 1964 was 23.2 to 41.7 percent higher than that of the parents. Since then, ways of utilizing rapeseed heterosis have been widely studied.

Professor D. T. Fu found polima cytoplasmic male sterility (CMS) of *B. napus* in 1972. The system of using three lines to produce hybrid seeds was developed by Hunan Academy of Agricultural Sciences in 1976. A double-high hybrid named Qinyou No. 2 (*B. napus*) was released in 1985 by the Science, Technology and Education Centre of State Farms and Land Reclamation of Shaanxi Province. The average yield of Qinyou No. 2 was 27.4 percent higher than in the Shaanxi rapeseed variety performance test carried out from 1984 to 1986. The sown area of this variety was nearly 2 million ha in 1992. The three lines of CMS with low erucic acid were set up by Huazhong Agriculture University in 1985. A single-low hybrid of *B. napus,* Huaza No. 1, was bred and popularized in rapeseed production.

In the early 1980s, SAAS found that genetic male sterility (GMS) of *B. napus* is controlled by two pairs of dominant genes with epistasis and has developed two-line and three-line methods with which to produce hybrid seeds. The hybrid produced by the three-line method was planted on 400 ha in Anhui in 1992. Its yield was 20 percent higher than those of local cultivars, but the quality was not good. The three-line with double low also has been set up in SAAS. A low erucic acid GMS hybrid, Shuza No. 1, was bred by Sichuan University and released in 1988. It was planted on some 9,000 ha in 1990, and its seed yield was 20.3 percent higher than those of local cultivars.

According to the data, hybrid seed was sown on more than 2.06 million ha in China in 1992. Approximately eighteen hybrids including nine CMS hybrids, one GMS hybrid, two self-incompatibility hybrids, and six hybrids produced by the chemical method were licensed in 1990. With continued study of rapeseed heterosis and release of hybrids, rapeseed production in China will be enhanced.

Biotechnology research on rapeseed has been conducted. Some progress has been achieved in anther and microspore culture, and resistance and tolerance to sclerotiniosis and virosis also have been studied.

The Oilcrops Research Network: Problems and Expectations

IORC, SAAS, QAAF, and XAAS have bred nine single-low and three double-low rapeseed cultivars with support from IDRC. These cultivars have been popularized, but no mill processes them exclusively. Since introduction of the fixed-oil-price system, on the other hand, urban inhabitants prefer imported refined oil to rapeseed oil because of the latter's strong odour. Most urbanites are willing to buy refined oil imported or produced by joint-venture enterprises, even though the price is almost double that of local products. The Chinese government is planning to reform the price system and assign high payments to high-quality rapeseed oil products. The *Brassica* Subnetwork will pay attention to policy study, processing technical training, and marketing development.

Hybrid rapeseed with high erucic acid and high glucosinolates has been widely used in the rapeseed production area. Chinese scientists face the big task of transferring high-quality rapeseed genes into these hybrids.

Sclerotiniosis and virosis, the major diseases of rapeseed in China, greatly influence rapeseed yields. Up to the present, few materials with immunity or high resistance have been found. Only a few tolerant materials have been found. Rapeseed breeding for resistance to sclerotiniosis and virosis needs international cooperation.

Chinese farmers are contracted by grain stations to grow rapeseed on a small scale on an individual basis. Because of this, the quality of seeds must be strictly controlled. The grain stations therefore need simple and quick methods for determining commercial seed quality. Developing such methods is one of the most important tasks ahead in high-quality rapeseed production and calls for great attention in the future.

In years past, the Oilcrops Research Network worked to facilitate exchange of germplasm, information on oilcrops production and research, training of breeders, plant protection, and other fields. The Oilcrops Networks also organized attendance at international meetings as well as technical tours. As a result, network countries' scientists have increased their research capacity.

The following objectives for the Oilcrops Research Network's future would be beneficial:

- Develop and support previous research achievements. Commercialization will benefit producers and consumers.

- Set up new projects to promote development of oilcrops production in developing countries.

- Provide technical assistance to identify and overcome constraints that have great influence on oilcrop yields.

- Build links among network members so that they can learn from each other.

- Organize network members to conduct cooperative regional tests in such areas as resistance to disease and germplasm research.

- Strengthen its function by recruiting donors, so that it can continue to play an important role in world oilcrops production.

1.4

The Sunflower Scenario in Asia and Africa: A Networking Approach

M. Rai

Indian Council of Agricultural Research

The oil economies of Asian and African countries are predominantly based on annual oilseeds cultivated mostly on rain-fed land. Farmers use limited inputs and often rely on obsolete production systems. Oil production is generally considered in isolation rather than as an integrated oil-oilmeal-protein system. Even crop researchers primarily dealing with production rarely consider an integrated-farming-system approach. Consequently, adoption of agroproduction and protection technologies at farm level are far below expectations. The skewed and limited growth of the sector has provided vast room for speculative trading and swings in prices as domestic production continued far below requirements, and as augmentation of oil availability through imports continued to be limited due to poor balance-of-payments positioning.

In most Asian and African countries, potential production for most annual oilseeds is far greater than has been realized. Although in the long run, in some countries, perennial crops such as oilpalm are likely to offer a solution, the issue needs to be considered in its totality and calls for integrated policy initiatives and harmonious development of the complete oilseeds sector.

Among annual oilseeds, sunflower offers great potential, as it can effectively be fitted to different regions, situations, seasons, and cropping systems. Photo- and thermoinsensitivity of sunflower has been observed to be greater than in any other annual oilseed. This lends added advantage to fitting sunflower into prevailing and potential cropping systems with few distortions. Availability of hybrids—which have yield advantages not only under ideal, input-intensive situations but also under marginal and submarginal rain-fed conditions—provides a further edge to the crop. Furthermore, the low volume and high value of seed and the necessity of replacing hybrid seed each year provide better opportunities for return on investment by the private sector through its research-and-development efforts.

The Sunflower Scenario in Asia and Africa

In Asia, sunflower is grown annually on an area of about 3 million ha with a production of about 3.2 million tons. The yield per ha varies but is approximately 1,000 kg/ha. In Africa, sunflower cultivation is undertaken in an area of around 1 million ha, with an annual production and productivity of 1 million tons and 900 kg/ha respectively. Among Asian countries, India has the highest acreage (1.2 million ha), followed by China and Turkey (0.65 million ha). Despite their lower area under cultivation, China and Turkey are the highest producers of sunflower, followed by India (see Table 1.4.1).

In India, the crop is grown in almost all the seasons: rainy, winter, spring, and summer. Presently, both public- and private-sector agencies place great emphasis on hybrid research and development. Consequently, five hybrids (BSH-1, APSH-11, LDMRSH-1, LDMRSH-3, and KBSH-1) developed through public-sector efforts and three (MSFH-1, MSFH-8, and MSFH-17) developed by the private sector have been released and notified for commercial cultivation. Under the Indian government's New Policy on Seed Development, launched in 1988, two additional hybrids, PAC 3425 and Advance, were introduced in the country for large-scale cultivation after a two-year multilocation evaluation and indigenous seed production after release and provisional notification.

Initially, sunflower cultivation was concentrated in the southern part of the country, but with the availability of new hybrid seeds, the area under cultivation is growing fast in the northern states, including Punjab, Haryana, and Uttar Pradesh, where average yields of 2 tons per ha are approximately four times the national average yield. Ideally, the area under cultivation in the northern region will continue to increase, particularly in the spring season.

Almost 98 percent of China's sunflower area is confined to the northeast, north, and northwest. China places great emphasis on hybrid development and commercial exploitation. In Pakistan, open-pollinated varieties such as Noor and Shams have been developed, and private-sector hybrids, namely NR-212, Suncross-843, Hysun-33, and Cargill 206, are grown. Among the new private-sector hybrids, Florem-206, Florem-280, Sunbred-245, Adalid-8, Romsun-150, and NK-212 have been tested and rated as promising.

Among the African countries, South Africa is the major producer of sunflower, with an area of about 462,000 ha under cultivation. Among the other countries, Morocco, Tanzania, Zambia, and Mozambique are also rated as important (Table 1.4.1). The southern zone of Tanzania has been suggested as a centre of secondary diversity for sunflower. However, the per-hectare yield of sunflower in Tanzania is one of the lowest among the African countries. Interestingly, in Sudan, Blue Nile Province was rated of high potential. In 1985, sunflower cultivation was initiated there in an area of 840 ha; the cultivated area rose to 154,000 ha in 1988 but fell to 23,000 ha in 1991, since the entire area was under exotic hybrids and no seeds were imported in that year.

In the entire region (except for India and China), research infrastructure and manpower is too meagre in the area of sunflower. As seed marketing in most countries is not well developed, private-sector efforts are limited. Under the circumstances, concerted research and development efforts in each of the countries are imperative to provide an initial thrust for the crop. The poor infrastructure for seed production, particularly in African countries, suggests the desirability of developing promising varieties/populations for commercial cultivation, so that farmers can use part of their produce as seed for four to five years; perhaps only then will some be prepared to purchase replacement seed.

Apart from improvements in yield, oil content, and maturity rates, concerted efforts are required if the region is to breed better varieties and hybrids with in-built resistance to various biotic and abiotic stresses. In India, diversification of male sterility systems for hybrid development, increasing oil content, and breeding for resistance to downy mildew (*Plasmopara helstedii)*, leaf rust (*Puccinia helianthi*), leaf spot (*Alternaria helianthi*), moisture stress, and salinity/alkalinity are rightly on the priority agenda. Among diseases, leaf spot in the Philippines, Pakistan, Thailand, Bangladesh, Nepal, and Tanzania; white rot in Morocco, the Philippines, Ethiopia, Kenya, Zambia, Uganda, Tanzania and Sudan; and charcoal rot in the Philippines, Egypt, Zambia, Pakistan,

Table 1.4.1: Area, Production, and Productivity of Sunflower in Asia and Africa during 1990

Country/Continent	Area ('000 ha)	Yield ('000 metric tons)	Production (kg/ha)
China	830	1,807	1,500
India	1,200	458	550
Iran	23F	1,043	24F
Iraq	24F	813	20F
Israel	11F	1,604	17F
Pakistan	35	1,200	42
Syria	15F	1,333	20F
Turkey	650F	1,385	900
ASIA	**2,925**	**1,083**	**3,168**
Egypt	11F	2,381	25
Kenya	3F	1,441	5F
Malawi	7F	652	4F
Morocco	120F	1,333	160
Mozambique	35F	571	20F
South Africa	462F	1,266	585
Sudan	112	357	40
Tanzania	81F	370	30F
Zambia	44	451	20
Zimbabwe	90F	729	66
AFRICA	**990**	**980**	**970**
WORLD	**16,288**	**1,355**	**22,072**

Source: *FAO Year Book* (1990).

Tanzania, and Sudan continue to be of paramount significance. Among insect/pest problems, damage due to birds is rated highest in almost all countries of the region. Further, cutworms and bollworms also pose a serious threat in almost all countries. Similarly, the lack of varieties/hybrids with a fair degree of tolerance to drought continues to be a concern in each of the countries in the region. In fact, all the countries have a common ground to travel in breeding for earliness, high yield and oil content, management of drought and birds, and resistance to cutworms, white rot, head rot, downy mildew, and leaf spot.

Achievements of the Sunflower Subnetwork

The Sunflower Subnetwork was established with the election of a chairman and cochairman during an Oilcrops Research Network meeting at Njoro, Kenya, in January 1988. Assessment of research problems was accorded first priority, so as to determine common working ground and encourage exchange of seed varieties/populations/ parental lines/germplasm; sharing of techniques, technologies, views, ideas, and information; and assessment of manpower availability and training needs, so that research-and-development problems could be tackled effectively.

After deliberation at the subnetwork workshop held in Cairo, Egypt, from 9-12 September 1989, a concrete action plan was drawn up, delineating specific responsibilities for speedy identification of priority areas/constraints surrounding development of improved populations; distribution of literature on sunflower breeding; transfer of technology through exchange of available packages; identification of races of downy mildew, sources of resistance to charcoal rot, drought, and salinity, and sources of earliness and high oil content; and management of white rot and insects/pests. Preparation of a review on charcoal rot was discussed and consultancy needs worked out for early implementation.

As many as sixty-nine varieties/populations/lines were exchanged through the network, in addition to bilateral exchanges of materials. Flow of information, techniques, and technologies was far greater than ever before. The network provided an opportunity and a common platform for discussing and formulating research-and-development strategies for translation into crop-improvement programmes. The support provided to the network countries for their scientists' participation in the International Conference on Sunflower held at Novisad, Yugoslavia, in July 1988 enabled scientists to get acquainted with the latest research on sunflower going on at the global level. The support provided to the leading sunflower scientists of countries outside the network for their participation in network workshops enriched member countries in the frontier areas of sunflower research.

Although only a few of the network's achievements can be measured in quantitative terms, the real gains were far greater than the expenditure incurred. The immeasurable indirect/direct gains realized on the ground are considered extremely valuable and desirable. Unfortunately, during this period, the continuation of the network itself was under debate, and due to lack of financial support, many of the important activities originally envisaged did not take place. The lack of financial resources drastically affected the chairman and cochairman's ability to monitor the programme effectively. Lack of manpower and resources for the network coordinator stationed in Ethiopia adversely affected the network's full functioning in catering for problems. Initially, a lack of financial resources and, finally, a fluid political situation deprived network scientists of much-desired training at the Institute of Field and Vegetable Crops in Novisad, Yugoslavia, in the area of plant breeding.

A Look at the Future

India and China are expected to continue to be better placed to help other countries in the region with their sunflower research-and-development efforts through their expertise, experience, and material.

Sunflower is potentially an important crop in the region. The private sector has a far greater role to play than ever before. Varieties/populations will have their important role as long as the organized seed industry in each of the countries is not well developed.

Sunflower networking could be by far the most rewarding in comparison to other oilseed crops, due to its inherent thermo- and photoinsensitivity. This quality endows varieties/hybrids with great adaptability, cutting across regions, seasons, situations, systems, countries, and continents. Furthermore, common ground acquired through breeding for high seed and oil yields, earliness, and resistance to various biotic and abiotic stresses could provide each country the opportunity to gain much more through networking than with isolated approaches.

To harvest the fruits of networking, centres of excellence developed in selected countries would be extremely desirable, so that pressing basic and strategic research problems could be tackled by utilizing the research findings of all network countries.

Most of the countries lack the critical scientific mass needed to tackle various pressing problems. Training of scientific/technical staff is absolutely essential.

The fact remains that overall networking would be most rewarding with suitable external support. If such support does not materialize, it would be desirable for the countries to develop and execute their bilateral/multilateral memoranda independently.

1.5
The Impact of IDRC Support on Ethiopian Oilseeds Research and Production

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Getinet Alemaw and Adugna Wakjira
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Oilseeds supply fat in the diets of most Ethiopians. The cake remaining after oil extraction is a major source of feed for livestock. The country has more than 150 registered small oil expellers, with an annual output of 2,200 tons of oil. The thirteen large government-owned oil mills have a production capacity of 90 tons of oil per day. These factories are working 49 to 66 percent below capacity, depending on the year, because of a shortage of raw materials. Also depending on the year, oilseeds are up to 13 percent of the country's total annual export.

Ethiopia's climate and soils are suitable for growing various oilseeds. Fifteen are currently grown, but only eight have economic significance. These latter are noug (*Guizotia abyssinica),* linseed *(Linum usitatissimum)*, mustard *(Brassica carinata)*, rapeseed (*Brassica napus)*, sesame *(Sesamum indicum)*, peanut or groundnut *(Arachis hypogaea)*, safflower *(Cartamus tinctorius)*, and sunflower *(Helianthus annus)*. Of these, noug and sesame have a unique role in the nation's economy. Noug is grown on vertisols with minimal inputs. It occupies about 60 percent of the area allotted to oilseeds (see Table 1.5.1). Sesame is cultivated in the lowlands of western Ethiopia, which mostly border Sudan. It is the major cash crop for small farmers and is exportable (see Table 1.5.2). It is also a good rotation crop for cotton grown in the Awash Valley and Gode.

Table 1.5.1: National Estimates of Oilseed Area (in '000 ha), Productivity (in '000 quintals), and Production (in '000 quintals) in Ethiopia, 1967-1986

Commodity	Year											
	1967-1971			1972-1976			1977-1981			1982-1986		
	A	Y	P	A	Y	P	A	Y	P	A	Y	P
Castor	21.7	5.4	11.8	12.7	5.4	83.0	-	-	-	-	-	-
Cotton	72.6	3.3	24.2	104.1	3.5	36.6	-	-	-	-	-	-
Groundnut	38.9	5.4	21.0	27.3	6.4	13.5	-	-	0.4	0.2	6.3	1.6
Linseed	117.8	5.1	60.3	100.4	4.2	41.9	42.6	4.2	145.1	71.8	5.1	339.5
Noug	393.9	6.3	249.9	209.9	4.1	100.4	116.0	3.7	247.1	165.4	3.8	-
Mustard	14.1	4.3	5.7	14.5	4.1	5.9	-	-	19.0	2.6	7.9	11.7
Sunflower	59.7	5.4	32.0	63.3	4.6	21.1	-	-	4.8	2.1	3.8	7.6
Sesame	126.3	4.6	59.6	153.9	5.1	73.0	-	-	33.1	4.8	1.1	4.7
Total	849.9	4.9	464.5	686.1	4.7	357.3	-	-	449.5	266.9	5.4	990.4

Source: Central Statistics Office, Addis Ababa (1980,1978, 1983, and 1987).

Recently, the Institute of Agricultural Research (IAR) has made oilseed crops for major agroecological zones a priority. In the highlands (>2,300 m above sea level), linseed and mustard are given high priority. In the middle-altitude zone (1,600 to 2,300 m) noug is the most important oilseed, and it is the crop with fourth priority. In the lowlands, sesame and groundnut are chosen, next to cotton, sorghum, and *haricot* bean. Although safflower, sunflower, and castor are not priorities, improvement of these crops will continue, with low emphasis.

In the past, four mustard, three linseed, three rapeseed, two noug, three groundnut, and four sesame varieties were released, with recommended production packages including sowing dates, seed rates, fertilizer levels, weeding practices, and disease and pest control.

Previously, oilseeds were classified as lowland and highland crops. Noug, *Brassicas*, linseed, and sunflower were considered highland oilcrops, whereas sesame, safflower, and groundnut were managed as lowland crops. For efficient management and communication, in 1988 the lowland and highland oilseeds teams were amalgamated to form the National Oilseeds Research Program. Because of this change, the three earlier phases of IDRC support to oilseeds research in Ethiopia are referred to as Oilseeds Ethiopia, Phase One.

Table 1.5.2: Estimates of Regional Production (in '000 tons) of Oilseeds in Ethiopia from 1979/80 to 1985/88

Region	Crop					
	Noug	Linseed	Mustard	Sunflower	Groundnut	Sesame
Arsi	25.51	86.90	10.74	8.78	-	-
Bale	0.18	17.53	9.98	2.14	-	-
Gamogofa	-	-	-	0.33	-	-
Gojam	199.98	35.51	11.53	0.60	4.60	0.50
Gondar	133.65	30.26	-	0.03	-	18.79
Hararghe	0.18	0.72	-	-	17.00	-
Illubabor	2.38	0.59	-	-	-	0.07
Keffa	0.09	0.08	-	-	-	0.09
Shoa	81.70	58.14	5.30	-	0.11	1.57
Sidamo	-	0.05	-	4.12	-	-
Wellega	139.49	3.94	3.48	2.78	0.41	0.36
Wello	11.40	32.40	0.17	-	-	0.12

Source: Central Statistics Office, Addis Ababa (1987).

Since 1981, IDRC has supported the oilseeds network project based in Ethiopia. This has facilitated the exchange of information and advice. A brief summary of the previous phases of the IDRC-supported National Oilseeds Research Program follows:

Production Trends

National Production

Eight oilseeds—noug, linseed, gomenzer/rapeseed, sesame, groundnut, sunflower, safflower, castor, and cotton are economically important (see Table 1.5.1). Between 1967 and 1986, noug and linseed contributed more than 75 percent of the national production and area allotted to oilseeds. Although the area under these crops has decreased, total production was increasing and production of sesame and sunflower was decreasing. Sesame was largely produced in Setit Humera, and security problems in Gondar have affected its production very much. Cotton is produced, largely for its fibre, in the Awash Valley, Gode and Gambella, and its production is increasing. The production of gomenzer/rapeseed was increasing from 1977 to 1986.

The average national yield per hectare of all oilseeds was quite low, compared to what researchers commonly obtain from demonstration plots. In general, the average yield has improved from 4.9 q/ha (1967-1971) to 5.4 q/ha (1982-1986). Gomenzer and linseed showed the highest average yield increment, probably because of relatively improved cultivation techniques and varieties made available to farmers after multiplication by the Ethiopian Seed Corporation.

Regional Production

Table 1.5.2 shows the regional distribution of oilseeds production between 1979 and 1986. Noug and linseed seem to grow in every province of Ethiopia. Together, the two accounted for more than 75 percent of total production, excluding cotton and castor. More than 90 percent of noug production takes place in Gojam, Gondar, Shoa, and Wellega. Linseed, with distribution even wider than noug, was largely produced in Arsi, Bale, Gojam, Gondar, Wellega and Wello. Most sunflower was produced on Arsi, Bale, and Sidamo state farms; most*gomenzer* also was produced in these areas, with the addition of Wellega and Gojam. Nearly all sesame production was concentrated in Gondar. Statistics available on groundnut are not accurate.

Exports

Between 1959 and1974, Ethiopia exported 72,657 metric tons of oilseeds, at a value of Birr 61.6 million annually (see Table 1.5.3); sesame accounted for 84.7 percent of these exports. This amount decreased at an accelerating rate until 1989. Between 1985 and1989, the country exported an average of 1,217 metric tons annually, with a value of Birr 897,000. Similarly, the exported amount and value of all other oilseeds decreased, probably because of the increase in local crushing. The value of castor seems to have been erratic and seasonal.

Table 1.5.3: Ethiopian Export of Oilseeds (in Metric Tons), 1970-1989

Commodity	1970-1974	1975-1979	1980-1984	1985-1989
Oilseeds	72,657	20,581	45,950	9,211
Castor	4,380	43,311	378	107
Cotton	15,953	4,871	2,000	1,413
Sesame	57,056	11,718	7,266	1,219
Others	9,399	2,627	8,841	6,540
Cakes			24,270	6,221

Source: National Bank of Ethiopia, Addis Ababa (1983 and 1989).

Imports

Ethiopia imported both industrial (palm) oil for soap manufacturing and edible oil (Table 1.5.4). In 1986 alone, the National Chemical Corporation imported 1,550 tons of palm oil at a value of Birr 1,660 million. These amounts increased to 3,070 tons and Birr 3,491 million in 1991. Edible oil also was imported through the Relief and Rehabilitation Commission (RRC). The RRC obtains its donations mostly from Christian relief agencies.

Objectives of Previous Phases

The broad objective of the project was to increase production of vegetable oil by small farmers, cooperatives, and state farmers. The intention was to raise local consumption of oil, assessing agroindustrial development and leading to the export of a surplus. This
was supposed to be achieved by developing high-yielding, stable varieties of mandate crops, along with appropriate cultivation techniques. The specific objectives were:

Table 1.5.4: Import of Palm Oil for Soap Manufacturing Factories in Nazareth and Gullele

Quantity of Palm Oil (Metric Tons)	Value (Birr)	Year
1,500	1,660,700	1986
2,100	2,043,080	1987
2,000	2,540,332	1988
1,800	2,196,311	1989
2,200	2,855,600	1990
3,070	3,491,600	1991

Source: Commerce Department, National Chemical Corporation, Addis Ababa.

- to develop high-yielding, stable varieties,
- to develop appropriate cultural practices,
- to verify and demonstrate the technologies generated,
- to supply breeder seed to the Ethiopian Seed Corporation,
- to ensure effective communication with extension workers and producers, and
- to strengthen and provide further training to the team.

Highlights of Previous Phases, 1981-1991

Varietal Development

Noug

A total of 2,752 indigenous lines were characterized at Holetta. Screening, followed by multilocation testing, resulted in a release of two varieties: Esete 1 and Fogera-1. Some additional and promising genotypes out of the mass and recurrent selection programmes are in the pipeline. Inbred line development and testing procedures are being studied. Dehulling techniques, which can help to identify less husky seeds/high-oil materials, were developed.

Linseed

A total of 980 indigenous, 99 exotic, 400 crosses, and 460 single-plant selections were studied at Holetta. Genotypes usually were tested on wilt-infested plots prior to yield testing. Based on multilocation testing of various genotypes, three varieties—namely, CI 1525, CI 1652, and Chillal—were released. The latter had 12 percent more seed and 9 percent greater oil yield than the former, with better disease resistance.

Mustard and Rapeseed

A total of 1,227 indigenous mustard (*Brassica carinata*) accessions were studied at Holetta. Screening of indigenous mustard and introducing rapeseed accessions for desirable traits, followed by multilocation testing, has contributed to the release of one mustard (Yellow Dodolla) and two rapeseed (Pura and Tower) varieties. It has been established that yellow-seeded lines yield more oil and better-quality meal than nonyellow-seeded lines of similar genetic background. Yellow Dodolla was selected out of Mixed Dodolla using this principle. Zero-erucic mustard was identified out of a cross (*Brassica juncea* line zem 2330 and *Brassica carinata* cv. Yellow Dodolla at BC_1F_2 generation).

Sunflower

Two early short genotypes out of the sunflower synthetic variety development programme (NSH-2 and NSH-25) are in the pipeline. These genotypes are suited to low-rainfall areas of the Rift Valley and Awasa area. One other genotype, Argentario, suited to high-rainfall areas, is in the pipeline.

Sesame

Testing of introduced and local germplasm at irrigated, high-rainfall, and low-rainfall areas has helped to release four varieties: S, E, Aba Sina, and Mehado-80. Aba Sina is bacterial-blight tolerant and suitable for high-rainfall areas of western Ethiopia, whereas Mehado-80 does better under irrigation, particularly in Awash Valley.

Groundnut

Evaluation of introduced germplasm from ICRISAT and the United States at irrigated, high-rainfall, and low-rainfall ecological zones has aided the release of four varieties: Shulamith, NC-4X, NC-343, and Roba. The varieties NC-4X, Roba, and NC-343 were developed for irrigated, high-rainfall, and low-rainfall areas respectively. One other early genotype ICG-273, suitable for low-rainfall areas, is in the pipeline.

Crop Management

Noug

Late June and early July were optimum planting times for midseason, late, and early genotypes. A seed rate of 2 kg/ha and 6 to10 kg/ha were found to be optimum for early- and late-season planting. Harvesting noug when the bud moisture content is about 40 percent—three weeks after 50 percent petal drop, or when plants turn yellowish brown—resulted in higher yield and minimum shattering without affecting oil content.

Linseed

Linseed responds to N and P fertilizers only under waterlogged conditions. Weeding twice (at early and midseason) or application of Pathoran at the rate of 2.0 a.i.kg/ha also controlled weeds. Full-season weed competition results in yield losses of up to 89 percent. On-farm verification of production packages, as compared to farmers' practices, showed that improved management resulted in a much higher seed yield.

Mustard and Rapeseed

Sowing-date and seed-rate trials using rapeseed cv. Target, turnip rapeseed cv. Torch, and mustard cv. S-67 was studied at Holetta, Kulumsa, and Robe. Highest yield was obtained from early planting and a seed rate of 6 to10 kg/ha. Among the species, mustard was the highest yielder, and Torch yielded least. Mustard and rapeseed yielded equally in short seasons.

Fertilizer trials conducted at various sites all over Ethiopia showed that rapeseed and mustard yields depend largely on fertility of soil. In many sites, a rate of 46 kg of N and 69 kg of P_2O_5 was optimum. Weeds can be effectively controlled by hand weeding once during the early stage of growth or by application of Alachlor at the rate of 1.5 kg a.i/ha. The relative importance of yield-limiting factors was studied at Holetta and Kulumsa. At Holetta, fertilizer, sowing date, and weeding were important, whereas at the more fertile site, Kulumsa, the order of importance for these factors was variety (mustard was better), sowing date, and fertilizer.

Sunflower

Planting sunflower from early to late June at inter- and intrarow spacing of 75 and 25 cm respectively resulted in higher seed yields. However, a plant population of 88,000 plants/ha at inter- and intrarow spacing of 60 to 75 and 25 to 30 cm was optimum for earlier genotypes.

Sesame

Harvesting sesame when one-third to two-thirds of the plant part is yellow resulted in a higher seed yield because of reduced shattering. Mid-June and mid-July were optimum planting times for sesame in Middle Awash and the marginal area of Bisidimo. There was no response either to fertilizer type or method of application.

Groundnut

Fertilizer showed no effect on pod yield. In groundnut, grass and broadleaf weeds could be controlled by application of Patoran at the rate of 3 g a.i kg/ha.

Diseases and Pests

Noug

A survey of noug diseases showed that noug blight, shot hole, and powdery mildew were important. Loss due to shot hole was not significant, probably because noug produces too many leaves per plant or because the disease appears at an earlier stage. A number of insect pests, including noug fly, which feeds on disk flowers; black and red thrips; and black pollen beetle were important. A parasitic weed known as dodder also attacks noug.

Mustard and Rapeseed

A survey of diseases in rapeseed- and mustard-growing areas showed that *Alternaria* leaf spot, white rust, and black leg were important. Leaf spot reduced seed yields by 14 percent and 5 percent on turnip rapeseed and mustard respectively. Recently, black leg on rapeseed has been found to be a serious threat. Among insect pests, cabbage aphid, cabbage white fly, flea beetles, and diamondback moth are considered most important.

Sunflower

In Ethiopia, downy mildew and sclerotinia were identified as important diseases of sunflower. Downy mildew can be controlled by planting sunflower during early June, up to the third week. It can also be controlled by dressing seed with Metalaxyl at the rate of 120 g a.i/100 kg of seed.

Sesame

A survey of sesame diseases in major growing areas showed that phyllody and bacterial blight are important.

Groundnut

A survey of diseases in groundnut-growing areas showed that leaf spot is the most important disease in high-rainfall areas. Rust is sporadic, observed only in eastern Ethiopia. Leaf spot can reduce seed yield by up to 65 percent but can be controlled by application of Benlate.

Seed Multiplication

The Ethiopian Seed Corporation (ESC) is mandated to multiply seed and distribute improved food varieties. ESC gets its breeder seed from the Ethiopian Oilseeds

Improvement Project. Every year the project supplies breeder seed of mustard var. Yellow Dodolla and S-67, linseed var. CI-1525 and CI 1652, rapeseed var. Tower, and noug var. Fogera 1. The corporation distributes the seed to state farms, cooperatives, individual farmers, and settlers. ESC is profit oriented and fully mechanized. Thus it does not multiply labour-intensive crops such as cotton, potato, sesame, and groundnut. The Ethiopian Oilseeds Improvement Project multiplies and distributes sesame and groundnut seed to settlers, state farms, and farmers. A total of 500 q of groundnut var. NC-4X, NC-343, and Roba and 150 q of sesame var. S, E, T-85, Aba Sina, and Mahado-80 have been multiplied since 1983.

The Institute of Agricultural Research is organizing a seed-multiplication division for crops such as sesame and groundnut. The division will be separate from the Ethiopian Oilseeds Improvement Project but will get its breeder seed from us.

Farming Systems

Numerous formal and informal surveys were carried out in the northwestern, western, central, and southeastern highlands by the Socioeconomics and Farming Systems Research Group of the Institute of Agricultural Research. In northwestern Ethiopia, noug is the second most important crop. Farmers plant noug at their convenience from May to July, but late June was mentioned as the optimum planting date. Farmers use a seed rate of 8 to 10 kg/ha, using neither fertilizer nor pesticides. The average seed yield per hectare was about 4 q. Farmers use noug for oil extraction and as a cash crop. The major problems associated with noug are insect pests, shattering, and parasitic weeds (*Cuscuta* spp.). Noug also was mentioned as the major crop and most important oilseed in western Ethiopia, with similar constraints on production.

Linseed is the major crop and most important oilseed in the northwest and southeastern highlands. Farmers plough one or two times and sow at a rate of 30 to 40 kg/ha. They plant linseed from May to June. The most important constraints on linseed production mentioned are wilt disease (in northwestern) and parasitic weed (in southeastern).

The available linseed and noug packages were evaluated on farmers' fields for profitability and acceptability. In linseed, both proposed varieties and cultural practices appear to be much more profitable than the farmers' usual practice. Farmers prefer the improved varieties CI 1525 and CI 1652 over their cultivars. In noug, improved culture shows dramatic effect. As a whole, improved packages were very profitable to farmers.

On-farm Trials

On-farm trials and demonstrations were conducted in some rapeseed-, mustard-, and linseed-producing areas to verify and disseminate the available production technologies. The trials were conducted during 1985 and 1986 using both improved and farmers' methods. The improved and local cultivars of mustard and linseed were tested under both management practices.

In the high-potential production areas, S-67, Pura, and the local check gave mean grain yields of 18.8, 7.7, and 15.3 q/ha under the improved method and 11.0, 2.6, and 9.4 q/ha under the farmers' method.

In the linseed on-farm trial, the varieties CI 1525, CI 1652, and the local check gave mean yields of 8.8, 8.8, and 7.6 q/ha in the high-potential areas. The on-farm trials of rapeseed, mustard, and linseed showed that management is very important for higher seed yield.

Following the on-farm trials, production demonstrations of mustard and linseed technologies were conducted in the Central Zone in 1987. The results showed that S-67, with its recommended packages, gave a mean yield of 15.5 q/ha, with a mean grain-yield advantage of 6.5 q/ha. Similarly, improved varieties of linseed gave mean grain yields of 6.9 q/ha and mean grain yield advantages of 2.7 q/ha.

In general, the on-farm trials and demonstrations showed that improved varieties of mustard and linseed give higher yields and greater benefits to farmers. Hence, to further disseminate the improved varieties of linseed and mustard, extension agents should conduct more demonstrations and popularize these technologies among farmers and encourage their adoption.

Groundnut varieties Shulamith and NC-343 were demonstrated around Babile and Bisidimo in the low-rainfall areas of Eastern Hararghe, the traditional groundnut-growing region of Ethiopia. The Red Cross also distributed these varieties. Today, groundnut yields around Babile and Bisidimo have risen from 9 q to 12 q per ha.

Facilities

Oil quantity and quality analysis equipment (a nuclear magnetic resonator and a gas chromatograph) were purchased during the early 1980s. In addition, laboratory chemicals, agar, and glasswares are available. Office buildings are at hand, and office equipment and computers have arrived.

Training

Getinet Alemaw and Adugna Wakjira (plant breeders) and Yitbarek Semeane (a pathologist) completed their M.Sc. degrees in Canada and rejoined the project. Ato Rezene Fessehaie is now working in weed science, having obtained his M.Sc. in Oregon in the United States. Ato Nigussie Alemayehu and Tenaw Werayehu are supporting the project after completing their M.Sc. degrees at Alemaya University of Agriculture, Ethiopia. In addition, three graduate students are undertaking study at Alemaya University of Agriculture. Technicians also took a total of nine short-term training courses.

Vehicles

Two Landcruisers, one for Holetta and the other for Melka Werer, and one Toyota pickup for Awasa were purchased. One Peugeot 404 and a Toyota pickup also were added for Holetta and Melka Werer respectively. Two more Landcruisers were expected in the last phase.

Constraints

Several constraints were present during previous phases. The most important factor was government or local funding. The Ethiopian Oilseeds Improvement Project is supported by IDRC. The Ethiopian government was supposed to cover staff salaries, casual labor, staff recruitment, per diems, and some materials and supplies. The government's failure to fulfil its commitment has been the most important problem. The project does not have a secretary or drivers, and, at times, even casual labor is unavailable. Local-purchase regulations and funds availability proved equally difficult. The project did not have enough vehicles to carry out on-farm trials.

Some important oilseed-growing areas were poorly secured. Areas such as Humera (the most important sesame-growing region) were inaccessible for several years. This limited the project's testing and extension activities. The previous government's quota and fixed-price policy hindered oilseed production a great deal. Farmers thus sold their oilseed at very low prices—although prices on the free or open market were four or five times higher than the government price—further limiting extension activities.

Future Directions

The future research activity of the National Oilseeds Research Program will be focused on varietal improvement, agronomy and physiology, farming systems, research and extension, farm implements, and cake utilization. More emphasis will be given to identification of constraints, extension work, and development of pre- and postharvest implements. General and specific objectives follow.

General Objectives

- Help increase production of oilseeds in Ethiopia by introducing better varieties and cultural practices, developing pre- and postharvest equipment, and improving by-product utilization and farming systems as well as dissemination of available technology.

Specific Objectives

- Continue developing high-yield varieties with better nutritional and industrial value and better resistance to major diseases;

- Develop mustard varieties with low erucic acid in their oil (<1 percent) and low glucosinolates in their meal (<30 μ mol) and black-leg-resistant rapeseed varieties;

- Identify, establish the economic importance of, and devise control measures for major diseases and insect pests.

- Intensify research on sesame and noug agronomy and physiology;

- Identify the relative importance of yield-limiting factors in noug, sesame, linseed, sunflower, and groundnut;

- Popularize the "newly" generated production technologies, including varieties of rapeseed, mustard, linseed, noug, sesame, and groundnut;

- Supply breeder seed for the Ethiopian Seed Corporation;

- Further strengthen manpower through training;

- Conduct a survey on oilseeds production and processing in the farming system in order to identify major production and processing constraints and beneficiaries, from production to consumption;

- Evaluate the supplementary value of oilseed cake for dairy and mutton production and the effect of different methods of processing on the feeding values of oilseeds; and

- Evaluate the ram press and pilot demonstrate its use in some rural areas; design a hand-operated groundnut sheller and an animal-drawn lifter.

Conducive Environment

The change in government has brought a new era to Ethiopian agriculture. Private ownership of dairy and fattening farms, big mechanized farms, feed production, and industry are now allowed. The Ministry of Agriculture and Environment is now shifting from villagization and settlement to extension and environmental rehabilitation. An extremely good opportunity for oilseed production is at hand. Ethiopia can use its resources to feed its people and export a large tonnage of oilseeds, as it did in the 1950s and 1960s.

Expected Output

High-yielding varieties of noug with medium maturity will be released in the second year of the new phase of the National Oilseeds Research Program at IAR. An early variety of noug adapted to lowland areas will be presented to the variety release committee in the second year of this phase. Fertilizer-responsive and better genotypes of noug for vertisol also will be identified during this phase. The effects of inbreeding and inbred line development techniques in noug will become known. Low linolineic acid (<1 percent) lines of linseed will be selected out of a cross between the CI 1525, CI 1652, Chillalo, and Australian lines. A sunflower variety with medium maturity and short plant height will be released in an early year of the phase. A high-yielding, semidehiscent, bacterial-blight-tolerant, white-seeded sesame variety will be released in the second year of this phase. Early, higher-yielding, and disease-tolerant groundnut varieties for the eastern zone will be released in the first year of this phase.

A low-glucosinolate mustard line will be identified and incorporated with low-erucic-acid trait in this phase. A black-leg-tolerant variety of rapeseed is also expected.

The extent of yield reduction due to noug blight will be estimated. Control measures and screening techniques will be developed. Recommendations for control measures of noug fly, noug flower thrips, and sesame webworm will be available following loss-assessment trials.

Some basic information in noug such as flower biology, inbreeding depression, soil-plant protection, and sink-source relation will be available.

The relative importance of yield-limiting factors for noug, linseed, sunflower, sesame, and groundnut will be identified in the first year of this new phase.

Released varieties of noug, sunflower, sesame, and groundnut, along with their packages, will be demonstrated. Those of linseed and mustard will be popularized.

The role of oilseeds in the farming systems of the Adet, Ghinchi, and Bako areas will be identified. The beneficiaries of oilseed production among the clients will be identified. The ram press will be introduced in selected areas of rural Ethiopia, and possible producers will be approached. The potential of oilseed meals to increase milk production in dairy cows and bodyweight in beef cattle will be studied.

Breeder seeds of noug, linseed, mustard, rapeseed, sesame, and groundnut will be supplied consistently to the Ethiopian Seed Corporation. Also, basic seed of sesame and groundnut will be produced at Melka Werer.

Gene sources for some fatty acids and major diseases will be identified.

The Oilcrops Network Project

The Oicrops Network Project was located in Ethiopia and has resided with the Institute for Agricultural Research since 1981. Between 1981 and1984, Dr. Kenneth W. Riley was the coordinator. He was actively involved in the national programme, and his research projects continue today at Holetta and Mekar. He used to share office and lab space with the national staff. In 1984, Dr. Riley was replaced by Dr. Abbas Omran, who led the project until 1992. From August to October 1991, both the national and the network projects were under evaluation. The results of the evaluation are the subject of this workshop.

The network acquired office equipment and furniture from the national programme. The project received a computer with its Laser Jet II HP and Citizen printers, two filing cabinets, two IBM typewriters, one old Nashua photocopying machine, a Kodak slide projector and, for furniture, two typing desks, four pedestal desks, and two bookshelves.

Impact of the Network on the National Programme

Training and Manpower Development

The network advisors have supervised a number of graduate students. Dr. Abbas also has trained IAR researchers in biometrics and was also a graduate-school instructor at Alemaya University of Agriculture. Graduate training for the national project was arranged and facilitated by the network. A total of six members of the national programme staff have attended three short-term network training courses.

Programme Development

The National Oilseeds Research Program was strengthened with the establishment of the network project. The network coordinator helped in a collaborative linkage with institutions such as the Agriculture-Canada Research Station, Saskatoon; the International Crop Research Institute for the Semi-Arid Tropics; and Chinese and Indian institutions.

Also, research projects such as recurrent selection of noug, quality improvement on mustard, and the cross programme on sesame were established with the support of the network.

Research Execution

The first oilcrops network advisor participated in several network research projects. The *Brassica* sowing date x seed rate x species trial carried out at Holetta, Kulumsa, and Robe was completed with his participation. The yellow-seeded mustard project was initiated with Dr. Riley's participation. The linseed selection programme and the crossing programme on sesame had the network advisor's participation. Some of the noug and sesame genotypes arising out of their efforts are now on the pipeline. The famous varieties, Yellow Dodolla (mustard) and CI 1525 (linseed), are indirect contributions of the network.

The network's research programme started with a collection of land races. Dr. Riley participated in germplasm collection for linseed, noug, mustard, sesame, and groundnut.

Section 2

Other Interventions in the Subsector

2.1
Oilcrops Commodity Research and the Production-to-Consumption Systems Approach

Luis A. Navarro
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Fats and oils are essential in the human diet. Most nutritionists agree that 20 to 25 percent of all dietary calories should come from fats and oils (FAO 1988). Nevertheless, underconsumption of fats and oils and related malnutrition are widespread. This problem is particularly severe in the fifteen nations of Africa and the five of South Asia that have the lowest per capita intake of fats and oils in the world.

Importance of the Oilcrops Commodity Group

Annual oilcrops are an important but underperforming source of edible oils and protein-rich presscake in most of the countries that are deficient in fat intake. The group underperforms in terms of its potential production of both coproducts, its effects on the environment, and its contributions to employment, income, foreign exchange savings/gains, and, particularly, improved nutrition among the resource-poor people in these twenty countries. Among the most notorious outcomes of this situation is the expensive—in terms of expenditure of limited forex—dependency on importation and use of lower-quality edible oils and the unavailability of protein cake needed to foster the production of animal protein and related goods and services.

Lower-than-recommended consumption of fats and oils among many poor rural communities, particularly oils of vegetable origin, is due in great part, although not exclusively, to environmental and socioeconomic factors that restrict or distort potential production, prices, and distribution of vegetable oils, by-products, and resulting income.

In many cases where poor communities could produce oilseeds and cooking oil for themselves and others, this is prevented by restrictions (e.g., market, credit) and competitive pressures originating within and beyond the communities. In other cases, even if communities were willing to consume more, fatty products are out of reach due to distance or price. Increasingly, also, other substitutes of lower nutritional quality compete with accessible fats and oils of vegetable origin in the household selection of foods.

The above puts into perspective 1) the urgency and socioeconomic importance of continued efforts to contribute knowledge with which to effectively foster and enhance the performance of the oilcrops commodity sector in many developing countries and 2) the complexity of the task and therefore the need for innovative methods with which to search for such useful knowledge effectively. The challenge most agricultural commodity research groups now face, particularly those dealing with annual oilcrops, is to gain greater appreciation and support for their research by properly orienting their efforts so as to benefit important and well-defined groups of people.

To meet this challenge, commodity research groups need effective mechanisms for selecting optimal research policies and interventions. Some researchers may opt to leave selection decisions to others. Most researchers, however, would like to participate in such decisions themselves. To ensure that their research results produce relevant effects and attract support for their work, researchers need to start with careful and conscious selection of their research settings and topics.

The production-to-consumption systems (PCS) concept constitutes one approach that may help researchers and other decision makers focus on research and research results-based interventions in order to improve the performance of a given agricultural commodity or commodity group (e.g., annual oilcrops). The PCS approach promotes identification of the relevant component (interest) groups within the commodity system, their individual as well as their combined expectations from and contributions to the total performance of the system, and their apparent problems and opportunities to improve such performance. Such information is a basic prerequisite for identifying relevant intervention entries within the system, including research opportunities and prioritized objectives from the perspective of different disciplines, individually or in combination. Even though the information provided by this approach is applicable to wider policy decisions or to related research in other relevant fields, it is equally useful for identifying and justifying narrower research objectives such as breeding sesame for a certain quality of oil in high demand. It also provides a framework for monitoring and evaluating the planned research process and results.

The Production-to-Consumption Systems Research Approach to Commodity Research

A clear understanding of the relevant production-to-consumption system should facilitate the process of making relevant research and research results-based decisions that will improve the performance of a target commodity or commodity group in a specified manner.

This proposition is based on the discernment that within an agricultural commodity (sesame, for example), restrictions on availability and accessibility exist at different points along the transect of processes and influences, from production of the raw product (e.g., sesame seed) at farm level up to and including the consumption of final products (e.g., cooking oil) and by-products (e.g., protein cake) from the commodity.

Presented differently, such understanding will help each researcher perceive how his (her) research fits within the production-to-consumption system (where, affecting whom, when, and how) and its potential direct and indirect effects (social, economic, environmental). This information is basic for defining and justifying priorities and for making research decisions that are explicitly relevant to someone, somewhere, somehow.

Lessons from the farming systems research (FSR) type of approach suggest the usefulness of the systems approach in guiding the search for such understanding. The systems approach requires definition of limits around the system, the critical interactions among the components, and the critical interactions of these with the environment outside the limits of the system. The composition and relation among components constitutes the *structure* of the system. The interaction (type, timing, location and intensity of exchanges) among components, and their interaction with the system's environment, constitute the system's *behaviour*. Finally, the net effects of the system's behaviour on its own components and on components of the environment constitute the system's *performance*. The dimensions of performance (e.g., crop yields, employment, income, etc.), the interactions, the components, and the boundaries of the system should be relevant to the decision makers and decision needs that motivated the analysis in the first place.

FSR has proven useful mainly where the scope of research decisions is restricted to production technology at farm level on a site-specific basis. Such scope appears too narrow to guide more general research policies with more than farm- and site-specific impact, particularly in the case of traditional food commodities that include oilcrops.

When the interest is in identifying commodity research priorities or policies with potential implications beyond a given farming community, the relevant system is *not* the farm. Building on experience, the proposition is that for any regional or national commodity-based research agenda, the relevant system is the regional or countrywide production-to-consumption system for that particular commodity. In other words, in the same way that the FSR approach can be used to orient agricultural research at a given site, the PCSR approach could help to orient agricultural research (and other policies) for a given commodity at a more aggregated level—either by region or by country—which also sets the stage for additional site-specific research. Thus the PCSR approach can make FSR even more effective, since it provides important insight about the environment surrounding the farm system and about the potential wider consequences of research results developed and utilized at farm level. In this way, PCSR and FSR are complementary approaches.

Summary

The production-to-consumption-system (PCS) is defined as the set of groups of people, the processes they command, and the interactions among themselves and the general environment that affect the production, processing, other components of marketing, and final utilization of a particular commodity or group of commodities such as oilcrops, sorghum and millet, or sugarcane. Figure 2.1.1 represents a first conceptual disaggregation of a PCS.

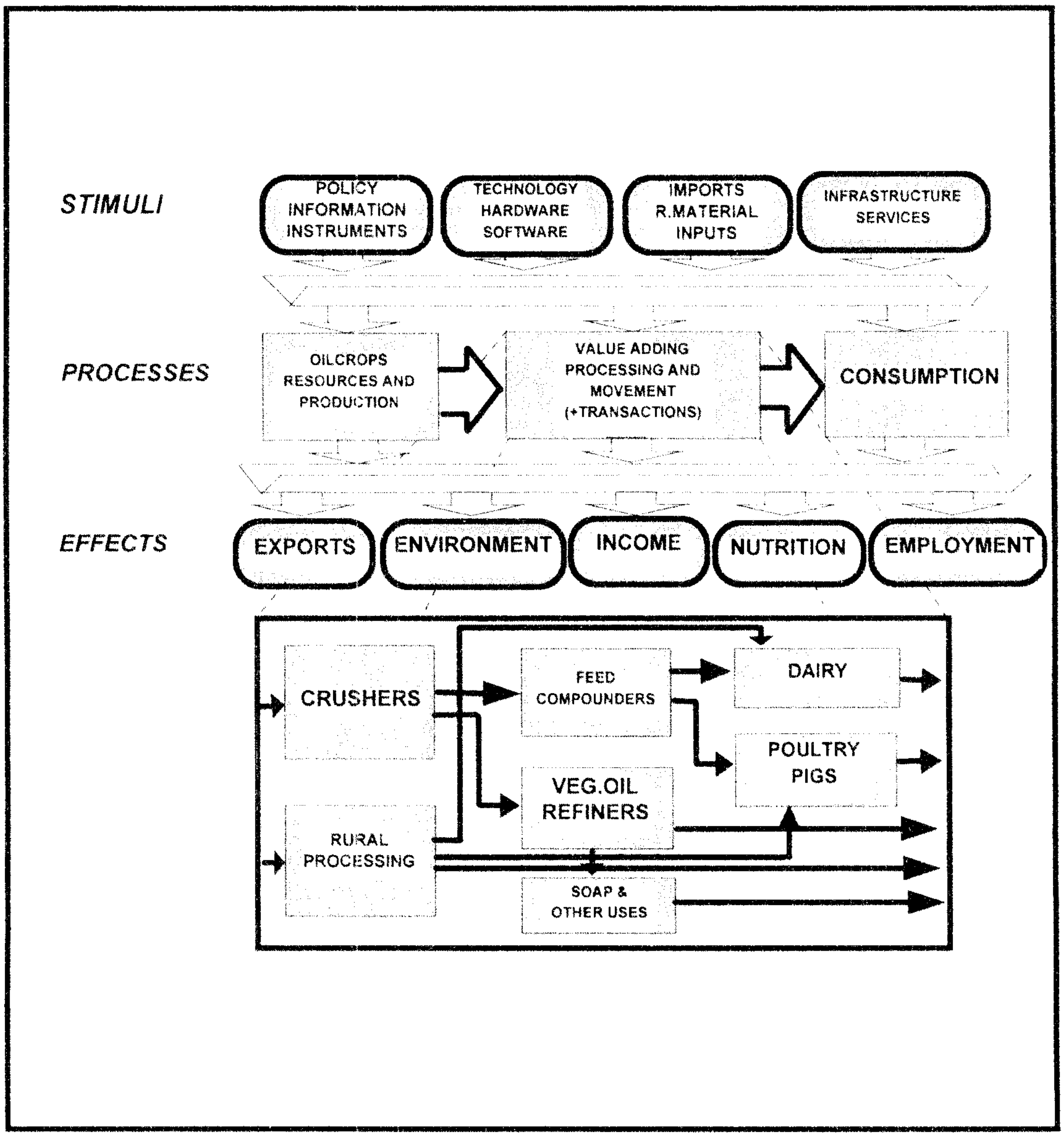

Figure 2.1.1: Production-to-Consumption Structure of the Vegetable Oil and Protein System

The production-to-consumption systems research (PCSR) approach is the approach to any research that focuses on part or all of a particular PCS with clear anticipation and concern for the spread and extent of the effects of research results (i.e., on the final performance of the PCS system).

This tool, still under development from experiences in Kenya, Nepal, and other countries, is proposed as a way of identifying means to improving performance of a commodity sector—i.e., to identify critical elements that affect selected dimensions of performance and ways to adjust them: technology, information flows, organization, policy angle. It stresses that the individual or networked action of agronomists and breeders (and, for that matter, of any other discipline in isolation) is not sufficient.

The basic hypothesis is that a comprehensive view of the system will serve the different groups interested in or able to contribute to the whole or to a particular aspect of the system's performance. The PCS approach is primarily a tool for working within a country. It is complex enough to suggest the advantages of networking among those struggling to develop, use those advantages effectively, and also provide valuable input to those who can use the outputs within a region or country (specific disciplinary teams, for example).

In summary, the PCSR initiative fosters the development and use of holistic systems approaches to obtain knowledge needed to effectively improve the performance of key agricultural commodities. Performance components include production, employment, income, forex savings/gains, food-security/nutrition, and their dimensions and efficiency in relation to the potential and sustainable utilization of resources.

2.2
The Production-to-Consumption Systems Research (PCSR) Approach to Agricultural Commodity Development: The Kenya Experience

Bernard T. Theora

The vegetable oil industry in Kenya faces some pressing problems, and the Vegetable Oil/Protein System (K) research programme is making substantial efforts to address these problems and develop a long-term strategy for the subsector.

Agricultural Development Objectives and Challenges

The agricultural sector is the mainstay of Kenya's economy. In 1991, the sector accounted for 31 percent of GDP and 60 percent of total export earnings and employed more than 70 percent of the country's work force. The overall economic growth and development of the country is therefore determined by the performance of the agricultural sector, which must respond to the following short- and medium-term challenges:

- providing food to a rapidly increasing population whose growth rate is estimated at 3.8 percent per annum,
- providing raw materials for a slowly developing agrobased industry,
- generating employment opportunities for an expanding labour force, and
- contributing to foreign-exchange earnings and savings.

The government of Kenya recognizes the central role agriculture plays in the economic development of the country, especially in ensuring self-sufficiency in the production of major food commodities. This is important in order to avoid the use of scarce foreign exchange on imports. The government's policy goals are outlined in the National Food Policy of 1981, reinforced in Sessional Paper No. 1 of 1986 on Economic Management for Renewed Growth, and reiterated in the Sixth National Development Plan of 1989/93.

Agricultural Growth and Development Strategy

The agricultural sector is constrained by the fact that only just under 30 percent of Kenya's land area is suitable for rain-fed agriculture. Given the country's concern for food security and the decreasing per capita availability of arable land, future growth in agriculture has to be generated by intensification of agricultural production, particularly aimed at increasing crop and livestock yields in the high-potential areas. To complement this intensification strategy, the country also has to consider opening up agricultural land in marginal areas. Oilcrops have potential in marginal areas, but efforts have to be made to ensure that the productive capacity of this delicate resource base is not compromised. This can be done with careful research on land, soil, and water management techniques coupled with breeding and agronomic practices consistent with protection of the environment, such as agroforestry research.

The Strategic Role for the Oilcrops Subsector

Given the challenges facing the agricultural sector, oilcrops have the potential to contribute significantly to Kenya's economic growth. They provide a sound base for industrialization due to their strong forward and backward linkages of various industries in the chain: the agriculture, extraction and refining, chemicals, soaps and detergents, and animal feeds industries. The potential for oilcrops industrialization is indeed great if an enabling policy environment is provided for the agricultural sector in general and, more specifically, for the subsector.

Problem and Justification

Although Kenya has a well-stipulated food policy that argues for self-reliance in major foodstuffs, for a long time the country has been spending large amounts of foreign exchange on the importation of edible vegetable oils and protein cake. For instance, since 1987, the country has imported 80 percent of its annual edible vegetable oils requirements. Along with edible oils, the country also imports protein-rich cake, the usual coproduct of oilseed processing, to be used in the compounding of animal feeds.

The demand for oils and fats for human consumption is expected to continue increasing due to population growth, income effects, changes in consumer preferences, and urbanization. Accompanying increases in demand for livestock products and the tendency to move toward intensive livestock (zero-grazing) production will continue to exert pressure for greater importation of protein cake not yet available locally .

In spite of the large quantities imported, Kenya continues to record one of the lowest levels of per capita consumption of separated vegetable oils and fats. In 1988, consumption was estimated at 5.6 kg/person/year, yielding the equivalent of 138 kilocalories per day. It is estimated that an additional 345 kilocalories, or two and one-half times this amount, was obtained from invisible sources of fats. The implication is that less than 20 percent of total dietary energy is supplied by fats. This figure is below the 25 to 30 percent recommended by the Food and Agriculture Organization (FAO) and the World Health Organization (WHO) for contributing to physical and mental development of human beings and averting stunted growth among children and reduced productivity among adults.

In addition, Kenya has a developing livestock-feeds industry that presently operates with an excess capacity. This results in lower than potential production of animal proteins, particularly milk and white meat, although the demand for these products continues to increase. This situation has contributed to the low consumption of animal proteins in Kenya, especially among the rural population. In 1991, the average consumption of milk was 72 litres/person/year.

Several oilseeds can thrive well in Kenya, including the country's marginal areas with low natural precipitation, which are unsuitable for other conventional food and cash crops. However, oilcrops receive a very small share of the country's resources, including land. Most farmers who grow oilcrops in Kenya work on small holdings and allocate less than one-tenth of their land resource to oilcrops. Due to the growing pressure on land, especially in the high-potential areas, opening up agriculture in the low-potential areas offers future prospects, particularly if the overall economy has to continue depending on agriculture for takeoff.

In addition, Kenya has adequate capacity to increase oilseeds processing with very little additional investment. For instance, approximately thirty-three oilseeds crushing and refining firms operate at an average of 30 percent of installed capacity. The crushing and refining industries are estimated to employ about two thousand people. Expanding capacity utilization would improve the use of resources and increase efficiency in the overall economy.

The plant and equipment in these industries was set up more than thirty years ago, however, and although increased domestic processing initially may not require additional investment, in the medium to long run, an overhaul of the industry will be necessary.

Although growth opportunities exist, previous development and promotional efforts in oilcrops have not gone very far; oilcrops are still accorded lower priority compared to the other food crops such as maize and beans and cash crops such as coffee, tea, and sugarcane in the allocation of public-sector investment funds. One problem the sector faces is that oilcrops, along with horticultural crops, do not rank very high when considered individually but are important as part of a functional group. Moreover, in the case of oils and fats, the official Kenyan aspiration for self-sufficiency has not been backed up with appropriate policies and technological packages needed to stimulate domestic oilseeds production, processing, marketing and utilization. Efforts in the sector also have been disjointed and lacking in coordination. Unless something is done, dependency on imported vegetable oils and fats will continue, especially if rapid population growth is taken into account.

The Development Challenges

Figure 2.2.1 is a representation of the prevailing national situation and the results expected after the successful implementation of development programs such as VOPS (K) to increase domestic production and processing of oilseeds.

The marginal benefits accruing to consumers of edible vegetable oils as their aggregate consumption increases are measured by the demand curve labeled AD_0, while the marginal resource cost by domestic producers of oil as their aggregate production increases is measured by the supply curve BS_0. If all imports were prohibited, then the equilibrium price would be at P_0, and the quantity demanded by and supplied to the population would be at Q_0.

Presently, however, imports are allowed, and the market price of edible oils is equal to P_w, which is equal to the border price of imported oils plus tarriffs and taxes levied by the government. P_s is lower than P_0, indicating that under the present supply structure, Kenyan producers are less efficient than foreign producers in production of edible oils. Given that imports are allowed and the final price is P_w, the quantity demanded by and supplied to the Kenyan population is $Q^d o$. Thus, under present supply conditions, forced self-sufficiency by prohibiting imports would be undesirable. Prices for consumers would be higher ($P_0 > P_w$), and per-capita consumption would be even lower than at present ($Q_0 < Q^d o$ for the same population). In terms of food-policy objectives, this would be contrary to the interests of the population, especially low-income groups. The ultimate objective is to attain self-sufficiency at a level of "reasonable" prices that ensures adequate per-capita consumption levels. The import price places a ceiling on the amount local producers can charge and thus also determines the quantity of local supply as it does with the quantity demanded by consumers.

When the market price is P_w, local producers will maximize their net returns if they produce only $Q^s 0$; this is because at this level of output, they will be equating the market price with the marginal resource cost. On the other hand, consumers will demand quantity $Q^d 0$ because it is the quantity at which the price is just equal to what they are willing to pay for the last unit purchased. The difference between what consumers

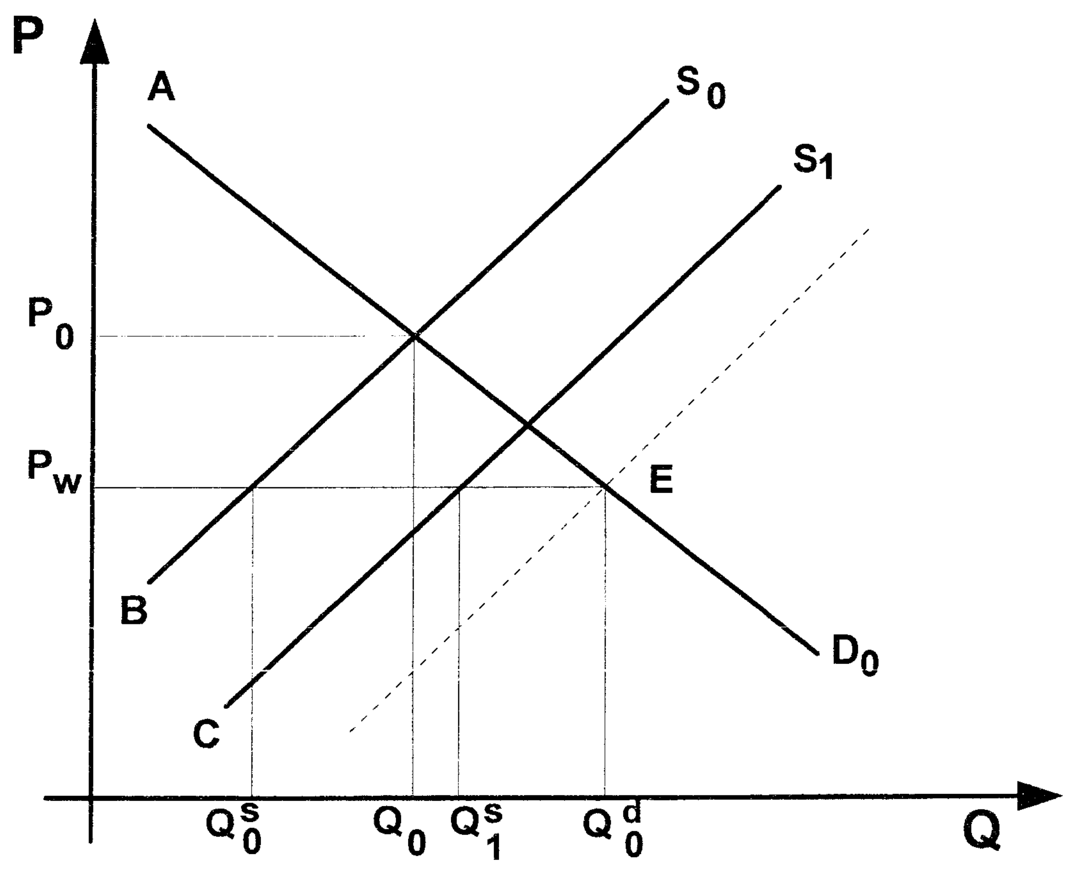

Figure 2.2.1: Potential Changes in Supply and Consequences in the Vegetable Oil Industry of Kenya

demand and what domestic producers supply at P_w is equal to the quantity imported from abroad $(Q^d0 - Q^s0) = M_1$.

The objective of VOPS (K) and several other programs is primarily to reduce the import bill and try to make Kenya self-reliant in edible oils/fat and protein cake at prices consumers can afford. The programmetherefore intends to create an enabling environment that generates and introduces appropriate oilcrops production and processing technologies that would enhance local efficiency and production of oilseeds and, ultimately, vegetable oils and protein cake. By implication, this would shift the supply of edible oils curve to the right in the figure. The new domestic supply situation is illustrated as a parallel shift to the right in the total market supply curve from BS_0 to CS_1. The new supply curve CS_1 now shows the after-programmemarginal resource costs. Given that the project will not influence the world price, P_w, the new quantity supplied from domestic production will be Q^s1. The project would therefore have increased local supply in $Q^s1 - Q^s0$ and reduced imports from $(Q^d0 - Q^s0) = M_1$ to $(Q^d0 - Q^s1) = M_2$.

Assume now that the shift in the supply curve is such that it intersects with the demand curve AD_0 at point E. At this point, the quantity demanded is equated by the quantity supplied from domestic producers at a price level that equates the domestic and international resource cost per unit. This is the ideal point of self-sufficiency that VOPS (K) and other programs envisage achieving in the very long run.

The foregoing analysis, however, assumes a static level of demand with a dynamic supply scenario. This situation is very unlikely, given that demand is influenced by increases in population and per capita incomes, urbanization, and changes in the tastes and preferences of people. It is more correct to view both demand and supply as moving targets.

The condition for self-sufficiency is that demand must be equated by supply at a price that permits proper per-capita consumption. It has been observed that more than 80 percent of Kenya's edible oils and fats requirement is met through importation. This implies that only 20 percent of demand is met from local sources. The discussion below examines the rate at which both demand and supply have to grow so that in the long run they are equal and hence satisfy the self-sufficiency condition.

Determining the Rate of Growth of Supply

The quantity demanded at a given point in time t in the future may be represented by the equation

$$C_t = C_0(1+r_c)^t \text{ . . . . (1)}$$

where

C_0 = quantity consumed or demanded at time t in the future,
C_0 = current consumption,
t = time in years, and
r_c = rate of growth of consumption.

Similarly, the quantity supplied at time t in the future is represented by the equation

$$S_t = S_0(1+r_s)^t \text{ . . . . (2)}$$

where

S_t = future supply level,
S_0 = current supply level,
r_s = rate of growth of supply, and
t = time in years.

Note that domestic supply presently is estimated at 20 percent of the country's total requirement, so that $S_0 = 0.20{*}C_0$. For self-sufficiency at time t in the future, we require that $S_t = C_t$, which is equivalent to the condition

$$S_0(1+r_s)^t = C_0(1+r_c)^t \text{ . . . . (3)}$$

Substituting 0.2^*C_0 for S_0 into Equation 3, we get

$$0.2C_0(1+r_s)^t = C_0((1+r_c)^t \cdots\cdots\cdots (4)$$

where

$$S_0 = 0.20^*C_0.$$

This implies that

$$(1+r_s)^t = (1+r_c)^t \div 0.2 \ldots\ldots\ldots\ldots (5).$$

Therefore,

$$(1+r_s) \;=\; (1+r_{c) + (0.2)}{}^{1/t} \ldots\ldots\ldots\ldots (6),$$

which implies that

$$r_s \;=\; (1+r_c) \div (0.2)^{1/t} - 1 \ldots\ldots\ldots\ldots (7).$$

The required rate of increase in domestic supply to attain full self-sufficiency at time t, given a starting self-sufficiency of 20 percent (i.e., 0.2), is represented by Equation 7, above. From this equation, it is obvious that the main determinants of the required supply response rate r_s are the growth rates of demand, r_c, the initial level of domestic supply, and the timeframe t for the program.

Starting at a low level of self-sufficiency, as is the case with Kenya's 20 percent of domestic production, domestic supply must, on average, grow faster than consumption. In other words, r_s must always exceed r_c, i.e., $r_s > r_c$. The shorter the timeframe, the more concentrated efforts must be. The longer the timeframe, the longer the effort must be sustained—but at lower intensity.

The Consumption Equation

The growth in consumption reflects the interaction between population growth and changes in per capita incomes, the two major determinants of growth in demand. Increases in population alone do not induce increases in effective demand.

The demand for vegetable oils and fats in Kenya is assumed to grow according to the following formula:

$$c = p + ng$$

where

c = percentage growth in demand,

p = percentage growth in population, and

ng = percentage growth in per capita consumption where n is the income elasticity of demand and g is the percentage growth in per capita incomes[1].

The current level of domestic production is indicative of the magnitude of the development effort required in order to attain self-sufficiency. The following section attempts to show the magnitude of the supply effort required in oilcrops. Present self-sufficiency is assumed at 20 percent, and different growth rates of demand are considered. The analysis that follows is based on the simultaneous growth of both supply and demand.

Table 2.2.1 shows the supply responses needed under different scenarios of growth in demand. It is assumed that income elasticity is positive but that per capita income can increase or decrease. Thus if per capita income were constant ($g = 0$), demand would grow at 3.8 percent per year, which is the rate of population growth. If there were increases in per capita income ($g > 0$ so that $c > p$), demand would grow at a rate higher than 3.8 percent, since the income elasticity of demand n is positive. A decline

[1] $c = p$ when $ng = 0$; $c > p$ when ng is positive; and $c < p$ when ng is negative.

in per capita incomes (i.e., g < 0) would reduce the growth of demand. It is therefore possible for demand to grow at a rate lower than 3.8 percent—say, 2.5 percent.

From Table 2.2.1, if demand is assumed to grow by 3.8 percent, then supply has to grow by 43.22 percent for the country to achieve self-sufficiency in five years. If, on the other hand, self-sufficiency is desired within a period of ten years, with demand growing at the same rate, then supply must grow at 21.93 percent. However, demand is expected to grow by more than the rate of population growth. Assume that demand grows at, say, 6 percent; this implies that supply would have to grow by 46.25 percent and 24.51 percent to achieve self-sufficiency in five and ten years respectively. A point to note is that the higher the rate of growth in demand and the shorter the period desired for attaining self-sufficiency, the higher the required rate of growth in supply. The questions, at this point, are: What resources are necessary for supply to grow at the rates shown? Are the rates achievable within the periods shown? What role should the government play to ensure that the industry achieves these growth rates? Some answers to these questions will come up as the discussion progresses.

The Scope and Focus of Development Efforts

The constraints that inhibit the performance of the vegetable oils/protein subsector in Kenya cut across production, processing, marketing, and utilization of the end products (oils and protein cake). From the onset, the VOPS programmerecognized that to effectively mobilize resources from both the public and the private sectors for the development of the subsector, it was necessary to adopt an aggressive, integrated strategy. The integrated approach has to be structured so that it harmonizes the interests of all players in the system (i.e., producers, processors, consumers) or subsector in a cost-effective manner. The approach adopted had the following task-oriented strategies:

- First, improve oilcrops (breeding and agronomic) production technologies for increasing farm yields and profits to farmers, especially smallholders;

- Second, encourage appropriate rural oilseeds processing technologies that would ensure availability of vegetable oil, particularly for vulnerable groups in rural areas;

- Finally, propose a conducive policy environment that would promote investment at all levels while promising good returns on investments.

The integrated approach adopted by the VOPS programmeis referred to as the production-to-consumption-systems research (PCSR) approach.

Table 2.2.1: Supply Responses for Self-sufficiency

Years to Self-sufficiency

Annual growth in demand	5	10	20	30	40	50	60	70	80	90	100
(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
2.00	40.73	19.81	10.55	7.62	6.19	5.34	4.77	4.37	4.07	3.84	3.65
2.50	41.42	20.40	11.09	8.15	6.71	5.85	5.29	4.88	4.58	4.35	4.16
3.00	42.11	20.99	11.63	8.68	7.23	6.37	5.80	5.40	5.09	4.86	4.67
3.50	42.80	21.57	12.17	9.20	7.75	6.89	6.31	5.91	5.60	5.37	5.18
3.80	43.22	21.93	12.50	9.52	8.06	7.20	6.62	6.21	5.91	5.67	5.48
4.00	43.49	22.16	12.72	9.73	8.27	7.40	6.83	6.42	6.11	5.88	5.69
4.50	44.18	22.75	13.26	10.26	8.79	7.92	7.34	6.93	6.62	6.39	6.20
5.00	44.87	23.33	13.80	10.79	9.31	8.43	7.85	7.44	7.13	6.89	6.70
5.50	45.56	23.92	14.34	11.31	9.83	8.95	8.37	7.95	7.64	7.40	7.21
6.00	46.25	24.51	14.88	11.84	10.35	9.47	8.88	8.47	8.15	7.91	7.72
6.50	46.94	25.10	15.42	12.37	10.87	9.98	9.40	8.98	8.66	8.42	8.23
7.00	47.63	25.68	15.97	12.90	11.39	10.50	9.91	9.49	9.17	8.93	8.74
7.50	48.32	26.27	16.51	13.42	11.91	11.02	10.42	10.00	9.68	9.44	9.24
8.00	49.01	26.86	17.05	13.95	12.43	11.53	10.94	10.51	10.19	9.95	9.75
8.50	49.70	27.45	17.59	14.48	12.95	12.05	11.45	11.02	10.70	10.46	10.26

Source: VOPS (K).

The PCSR Approach: Definition

The Vegetable Oil Protein System (K) programme adopted the production-to-consumption systems research (PCSR) approach, a new technique, in its attempt to establish a priority agenda for research and policy interventions in the oilseeds sector. This technique focuses on the identification of transactors, starting with the participating groups and their interactions during the processes in which they participate to transform a raw commodity into finished products used by consumers.

PCSR has proven to be a very realistic and effective tool with which to focus and steer commodity research, policy, and technological interventions intended to improve the overall performance of a commodity sector as a subset of the national economy. Overall commodity performance is finally assessed in terms of its contribution to food security, employment, income and distributional impact within society at the macro level.

Correctly used, PCSR is directed to identify strategic points and forms of interventions in order to improve the performance of the commodity system. This objective requires analysis of the current structure and behaviour of the subsector and an understanding of the relations of these to its overall performance and the environment. This implies a conceptual breakdown of the system into its macro-level components, featuring the most influential interest groups and the interactions of these components with each other and with the environment.

Because of its nature, PCSR also requires the work of interdisciplinary teams that approach and effectively incorporate the participation of intended final beneficiaries and other users of the expected research results. Furthermore, the approach emphasizes an incremental sequence of strategically planned and executed research steps, each of which starts with analysis/evaluation of information already accumulated. It provides the flexibility needed to respond efficiently to the site and time specificities of the research subject and of the research team's capabilities and resources.

The Research Strategy and VOPS Experience

The Kenya government highlighted the scope of the problem of import dependence for edible vegetable oils in its Sessional Paper No. 1 of 1986 on economic management for renewed growth. This important strategy paper states the government's desire to reverse the trend in the vegetable oils industry.

Efforts in oilcrops development in Kenya date back to the 1970s, particularly 1979, when the government of Kenya, through the Ministry of Agriculture, Kenya Seed Company, and East Africa Industries (EAI), signed a tripartite agreement to conduct research into appropriate oilcrops for marginal-rainfall areas at Wanguru in Embu. The three parties recognized the potential in developing oilcrops appropriate for marginal-rainfall areas, leaving high-potential areas for food crops and other high-value export crops.

Encouraged by the Wanguru experience, EAI launched an oilcrops division that undertook the growing of sunflower and rapeseed in both the eastern and western Rift Valley. International palm oil prices increased steadily between 1981 and 1984, when they peaked at US$ 951 per metric ton. The local industry responded by expanding domestic production from a meagre 1,000 metric tons in 1981 to 8,000 tons by the end of 1984. In 1985, the Commonwealth Development Corporation, through the International Finance Corporation and East Africa Industries Ltd., positively evaluated oilcrops growing in the country. The company they formed, Oil Crop Development Ltd. (OCD), was to develop local oilcrops and reduce the country's excessive import bill for edible oils.

OCD approached Egerton University and requested the use of students to promote the production of sunflower in Eastern, Central, and Rift Valley provinces. The students were charged with the responsibility of distributing free seeds to farmers. This campaign was so successful that by 1987, OCD had spread the growing of sunflower and rapeseed to about eighty thousand small- and large-scale growers spread over twenty-two districts of the country. Production of sunflower and rapeseed increased from 8,000 to 20,000 metric tons during the same year.

In 1986, however, international palm oil prices fell to their lowest level ever, US$197/metric ton, making local production of oilseeds relatively expensive. The result was that the OCD project no longer could be implemented on a commercial basis. Companies promoting local oilseeds incurred prohibitive additional costs compared to companies that refined and packed edible oil and fat products from imported palm oil.

Responding to a different concern, in 1986 the International Development Research Centre (IDRC), which had funded oilcrops research in Africa, the Middle East, and Asia for the previous ten years, started to question the rationale for continuing to finance oilcrops research at a time when international prices were showing a downward trend. The observed trend was mainly due to more rapid growth in overall supply than in demand, and stocks of oilseed products were building up internationally. The possibility of continuous overproduction and collapse of the market was seen as a real threat to oilcrops research efforts. IDRC hypothesized that international vegetable oil prices would drop to such low levels that they would negatively affect domestic production of oilseeds. Under such circumstances, continued investment in the generation of production technologies through agricultural research in oilcrops would be ineffectual.

After extensive internal consultations, in November 1987 IDRC engaged a consultant to examine the Kenyan oilcrops situation as a case study and to determine the potential for oilseeds production, processing, and utilization in the country. The consultancy findings led to a statement on the future of the oilcrops research strategy for the country and the region. The whole development process in Kenya was conceptualized as requiring a four-stage programmethat would ultimately investigate the technical and economic feasibility of oilseeds production, processing, and utilization of edible oils and protein cake in Kenya. The removal of constraints identified in the investigative stage would lead to development of the subsector.

Evolution of the Research Strategy

The oil/protein subsector was conceptualized as a system with several interacting components that would have to be analyzed individually and collectively for total understanding. The whole process was conceived as a four-stage programmeto investigate the economic and technical feasibility of oilseeds production and processing of edible oils and protein cake in Kenya , thereby developing the industry. The four stages were developed as follows:

- A preliminary review of the information pertaining to the oil/protein system. This initial diagnostic task, which involved consultation with academicians, government officials, and industry representatives, led to the formulation of a proposal for a comprehensive investigation of the individual components and the system as a whole. The timeframe for this stage was November 1987 to April 1988.

- More detailed diagnostic studies of the various components within the subsector aimed to identify key intervention points for technical and policy interventions. This stage started in May 1988 and ended in October 1988.

- In-depth field research and trials relating to technical or policy interventions considered necessary to sufficiently develop the oil protein system in Kenya. This stage was conducted between July 1989 and June 1992.

- The implementation of various recommendations based on field-research results. This stage was to begin in January 1989 and continue for all promising recommendations.

The Incremental Approach to Research Planning and Development

The stages described above were developed under the principle of the incremental approach, whereby the next research activity is derived from the findings of the previous step. This approach evolved into six steps for research and development of the oil/protein system in Kenya. These are

- statement of the situation,

- delineation of the subsector,

- characterization of the system,

- design of activities,

- establishment of a long-term strategy, and

- implementation, monitoring and evaluation.

The concept of the incremental approach contains the notion that knowledge and understanding of the system and the economic, social, and political environment in which it evolves must be generated sequentially because tomorrow's research can not be properly defined until today's results are well documented. The decision to continue research is based on previous satisfactory performance demonstrated by the quality and relevance of the results previously obtained.

In the following exposition, each of the six steps is analyzed in greater detail, followed by a description of the experience gained during implementation of the VOPS (K) program.

The Situation in Kenya

Kenya was heavily dependent on foreign vegetable oils. In 1987, more than 80 percent of edible vegetable oils and fats were imported from Southeast Asia at an estimated cost of US$ 50 million per year. This was the highest foreign-exchange expenditure on an agricultural commodity, surpassing both rice and wheat. In spite of this level of importation, the 1988 per capita consumption of edible vegetable oils and fats in Kenya, estimated at 5.6 kg per year, was well below the world average of 14.7 kg per year. This level of consumption provided energy from visible fats and oils below the 20 percent level recommended by the World Health Organization and the Food and Agriculture Organization of the United Nations.

The demand for oils and fats for direct consumption as well as for the production of soaps and detergents, was expected to increase substantially as a result of population growth, urbanization, increases in per capita incomes, and changes in people's tastes and preferences. The same factors would boost the demand for protein cake due to high consumption of livestock products and the more intensive livestock production techniques. The combined effect of all these forces was expected to result in a significant increase in the demand for foreign exchange to import both vegetable oil and protein cake.

On the other hand, Kenya has suitable agroecological conditions to cultivate several kinds of oilseeds, particularly in the extensive but underutilized marginal areas. The area allocated to oilcrops, however, remains low, and the overall level of production is very low because of the poor yields farmers achieve. Moreover, the low quantities of oilseeds produced and processed into oils and fats for human consumption results in reduced amounts of protein cake, an important input in compounding livestock feeds. The animal-feeds industry continues to depend on imported protein cake. Given the constrained foreign exchange position in Kenya, most animal-feeds firms operate below their capacity. This supply/demand imbalance in the oil/protein system has adversely affected commercial dairy, poultry, and pig operations. In 1987, some eighty thousand farmers grew oilcrops on an estimated area of 125,000 hectares. The area under oilcrops has been declining since, and the number of farmers also has fallen.

Statement of the Situation

The situation described above was known before IDRC's work on oilcrops in Kenya was begun in 1987. What was needed in order to proceed was a thorough review of the commodity system, leading to a better understanding of the subsector. In November 1987, IDRC hired an international consultant to interact with Kenyan university researchers, key government officials, and representatives from the industry. This was the start of a consultative research approach that has prevailed throughout the design and implementation process of the VOPS (K) program. The fundamental question asked at this stage was whether the then-prevailing situation was satisfactory. All the people consulted agreed that the situation was not satisfactory, and that it should not be left unattended.

Delineation of the Subsector

A more thorough understanding of the system was found to be necessary. Since the experience gained in the previous study by the consultant had shown that it was not feasible in the short run to do a comprehensive quantitative study of individual components of the oil/protein system in Kenya, the first effort was descriptive.

The description of the subsector started with an examination of the world market situation, since production of oilcrops in Kenya, a net importer, is highly influenced by the world prices of palm oil, the country's main oil import. In the absence of import restrictions, the domestic prices of oilseeds were derived from international palm oil prices. Local farmers, in essence, competed with foreign producers. The local prices of oilseeds were therefore as variable as the international palm oil prices from which they were derived. This price variability had adverse effects on local oilseed farmers such that, when world prices of palm oil fall low enough, farmers go out of production.

To analyze the international market, monthly price data for the major edible-oil and oilseed-meal prices covering the period 1981/82 to 1986/87 were examined. One striking feature was the great variability of prices; in some cases, prices doubled within a period of two years.

Other features observed included

- Oilseeds produced by the farmer went directly to the oils and fats industry, where they were crushed to produce oils/fats and protein cake. The oils/fats were consumed directly without further processing. The protein cake, on the other hand, was used as an input in animal-feeds compounding, especially for dairy and white meat production.

- The margins between the imported commodity (palm oil) landed into the country and the retail price of cooking fat for consumers were huge, suggesting potential for rural processing.

Conceptually, the delineation of the subsector entailed having a broad idea of its components, the major inputs and outputs, the forward and backward linkages, the relative importance of the local and international markets, and finally, the economic and social significance of the system. The result of this delineation activity was a basic diagram showing the components of the system and their linkages.

The information obtained from the delineation exercise was used to create awareness among senior Kenya government officials, the private sector, the universities, and donor agencies. At this stage, more than forty Kenyan professionals were involved. They consulted each other and then concluded that the subsector was important and that the problems thus far identified needed attention. Seven working groups were formed and mandated to prepare a proposal to characterize the system in greater depth. Egerton University was identified as the institution with the commitment, leadership qualities, and strategic placement to undertake and coordinate the research work. Resources were subsequently allocated by both IDRC and the Kenya government for this purpose. With technical assistance from the principal investigator and the consultant, the seven groups prepared research proposals characterizing the system in greater detail.

Characterization of the System

The Kenyan vegetable oil/protein subsector was described as follows:

- Many farmers were producing oilseeds used as raw materials for the fats and oils industry. Major oilseeds supplied included sunflower, sesame, and rapeseed. Cotton and maize both provide by-products—cottonseed and maize germ—that are important sources of edible oil and protein cake. These crops were not grown specifically for oil or protein cake production, however, and the price of corn or cottonseed oil may not directly influence production of these crops.

- There were several rural and urban oil extraction/crushing industries but few refining and packaging industries. The refining industries exercised some sort of monopolistic influences over the extracting industries. Equally, there were few animal-feeds industries, and these also exercise both monopolistic and monopsonistic influences. These powers were sometimes curtailed by the government through its licensing and price-control mechanisms.

Oilseeds in Kenya were grown as secondary crops, and farmers used few if any inputs, which often resulted in very low yields. At the processing level, old pressure expellers were grossly underutilized. The country had one solvent-extraction firm that utilizes maize germ as a raw material. There was very little experience with rural oilseeds processing and utilization.

Regarding the policy environment, the following points were observed:

- Oilseeds were scheduled crops, implying that the producer price was to be regularly reviewed and announced by the government.

- Although there were duties on imported oils and fats, they were made ineffective by remissions.

- The government sets type-A price controls for oils and fats at exfactory, wholesale and retail levels.

- Type-A price controls were in effect for maize and milk.

- Type-B price controls were in effect for animal feeds but were removed in 1990. (The manufacturer requests type-B price controls from the government through formal communication of price adjustments for his product based on the price of inputs or related factors.)

- Prices of beef, poultry, and pig products were determined by market forces.

- Type-B price controls were in effect for soaps and detergents (removed in 1989).

The subsector was found to operate under a set of policies as shown above, some of them general in nature, such as exchange rate, general taxation, input subsidies, etc. However, many of these policies are commodity specific, e.g., price controls, import and export quotas, duties or promotions, movement restrictions, credit lines, direct subsidies, etc. The foregoing suggested the absolute necessity of understanding the components of the system, how they operate and interact, and the technology and policy environments under which they operate if appropriate decisions are to be made in order to remove the constraints affecting them.

After the characterization of the system was finalized, the results from the study groups needed to be discussed. This was done at two levels. First, a workshop was held among the members of the seven working groups mentioned earlier. In this workshop, results and findings were presented to a cross-section of participants drawn from key government ministries, the private sector, and the university community. This workshop helped propagate understanding of the oil/protein system in Kenya. In addition, consultative meetings were held between the principal investigator and senior government officials. The basic question addressed was whether the issues raised by the study teams were relevant for government programs. The government expressed its commitment to and support for the work undertaken by Egerton University and other institutions in developing oilcrops in Kenya.

Design of Activities

Having identified the areas that needed technical, policy, and research interventions, a two-tier programmewas adopted. The first tier entailed setting up a technically qualified research team with the objective of drawing up an action agenda for research on technical as well as policy interventions considered necessary and sufficient to develop the subsector. This team, established at Egerton University's Research and Extension Division, was also charged with the responsibility of designing and coordinating activities geared toward development of the subsector. The second tier comprised a set of distinct, although linked, activities that later formed the VOPS satellite projects. These satellite projects were to be implemented by other collaborating institutions such as the Ministry of Agriculture, University of Nairobi, Kenyatta University, and other national research institutions.

Activities that required neither technological nor policy changes—for example, extension work on oilcrops using existing crop-production technology, studies biased toward improvement of both factor and output markets, and studies geared toward understanding the land-tenure system and opportunities available for development of contract farming arrangements—also were identified. This was achieved through regular consultations with the public sector, parastatal organizations, farmers, and participating industries.

Specific activities designed under this category included, among others, rural oilseeds processing using the manually operated ram press. This rural oilseeds processing activity was later developed into a satellite project with several components:

- agricultural engineering,
- crop technology,
- home economics,
- animal production,
- agricultural economics, and
- credit and finance.

This project is being implemented by the Department of Agricultural Engineering at Egerton University.

The other activities designed under this category were specific to oilcrops research. Two crops, sunflower and sesame, were identified as priorities for research. This choice was guided by the fact that the two are widely grown in the country; require few purchased inputs; do relatively well as complementary crops; do well under low moisture conditions, making them well adapted for semiarid areas; and are easy to process using manually operated ram presses. On closer scrutiny of the two crops, sunflower—grown predominantly in high-potential areas—was eliminated from the research program, since the national agricultural research centres already were attending to the crop. Sesame, on the other hand, had received only a little attention, at the regional research centre at Mtwapa in Coast Province.

In line with this, the Sesame (K) Improvement Project, a research programmeto develop agronomic packages based on existing practices, germplasm buildup and selection, and applied agronomic research was developed and is being implemented by the University of Nairobi under the VOPS (K) programmeat Egerton University.

Another activity was the deeper study of the structure, conduct, and performance of the vegetable oils/protein industry in order to identify policy issues that required attention. This activity became the third satellite project, implemented by Kenyatta University.

Within the Kenyan context, the vegetable oils/protein system was found to be controlled by a set of policies that were detrimental to its development. There was therefore a felt need to design and offer enabling policy options to government policy makers for consideration. The core team at Egerton University prepared a document that analyzed existing policies within the subsector and offered what the team perceived as appropriate alternatives that could reverse import dependency.

The main component in the policy option presented was the introduction of a variable levy to replace the existing ad valorem duty. The purpose of the variable levy was to counter the international price variation that the domestic industry faced. The levy was intended to result in a threshold price for goods landed in the country that is higher than the world price. The difference between the threshold price and the variable world price is the levy. The levy therefore varies in order to maintain a steady threshold price. For this policy to work, however, other complementary policies were required. These include

- a fund for development of the subsector drawn from the levy,
- price decontrol at exfactory, wholesale, and retail levels,
- strengthening of agricultural research and extension,
- promotion of rural oilseeds processing technology that would make vegetable oil/protein available at an affordable price, especially to the vulnerable rural population,
- a long-term commitment on the part of the government, especially to the implementation process, and
- a system for monitoring and evaluating the subsector in order to adjust the threshold price to reflect evolving circumstances.

The policy framework outlined above has been presented and discussed by policy analysts and their recommendations submitted to policy makers within the public and private sectors.

The VOPS (K) programme already has witnessed some positive policy changes within the subsector: for instance, the decontrol of animal feed and margarine prices and the reintroduction of an effective import duty on imported palm oil. The rescheduling of oilcrops is the most recent change.

Mobilization of Resources for Action

After the design of activities, the next stage entailed the allocation of resources (human, time, and material), in order to effectively design and implement the activities while simultaneously mobilizing other resources within the subsector. This exercise (i.e., research execution, policy changes and implementation of the other activities) would result in new activities designed under new policies and improved technology. This eventually should lead to the formulation of a long-term strategy for development of the subsector under new decision parameters.

Implementation, Monitoring, and Evaluation

The longer-term outcome of the production-to-consumption systems approach is the development and implementation of a long-term strategy and a monitoring and evaluation system for the entire subsector, using a model that will detect technological problems, policy discrepancies, and managerial weaknesses for timely intervention or adjustment. This continuous and systematic process of assessment will ensure development and achievement of set targets within the subsector.

VOPS and the Future

After the successful implementation of the six stages of the VOPS programme as described above, the production-to-consumption systems research approach will be documented and applied to other commodity sectors of the Kenyan economy. The approach also will be disseminated to other countries of the region, particularly those that face similar constraints in developing their vegetable oil subsectors. This dissemination has begun through the IDRC-funded Oil Crop Research Capacity, which is being implemented by the Agricultural Research Foundation (AGREF).

2.3

Production-to-Consumption Systems Research: Application to Countries in Eastern and Southern Africa

J. Mbwika, D. Mwiraria, and S. Chema

Agricultural Research Foundation

The Agricultural Research Foundation (AGREF) currently is involved in a project with the goal of transferring production-to-consumption systems research (PCSR) techniques, developed at Egerton University in Kenya by the Vegetable Oils and Protein System-Kenya (VOPS [K]), to other countries in East and Southern Africa. The transfer is taking place through the Oilcrops Research Capacity (East and Southern Africa) Project, conceptualized in 1990, which has been funded by the International Development Research Centre (IDRC). The project is a joint venture between AGREF and IDRC, with AGREF the executing agency. The project aims to determine whether the VOPS (K) methodology is widely transferable within Eastern and Southern Africa, or if certain changes and adaptations would make it so.

VOPS (K) at Egerton University, Kenya

The Vegetable Oils and Protein System Project at Egerton University began in 1987 as an attempt to address the edible oils problem in Kenya. At the time, the country's edible oils import bill stood at about Ksh 1.2 billion per annum; at the same time, the country's per capita intake of edible oils was among the lowest in the world. The VOPS (K) project was expected to catalyze and help steer public and private efforts toward improvements in the sector's performance, thus realizing its potential contribution to general agricultural development in Kenya. The core objective of the project was to improve domestic production and processing of oilseeds for vegetable oil and protein cake through the promotion and support of appropriate research leading to technological, organizational, and policy amelioration.

In its diagnostic study of the subsector, VOPS (K) identified complex constraints to performance at all levels of production, processing, marketing and utilization. This meant an integrated approach to problem-solving was needed, an approach encompassing both technology and policy-related issues. This approach—PCSR—attempts to examine the whole commodity subsector in order to establish a priority agenda for research and policy intervention. The technique focuses on the identification of relevant component interest groups and the process by which they participate in the commodity system, from production of raw commodity to consumption of finished products by consumers; their interests and expectations from and contributions to the total performance of the system; and their apparent problems and opportunities to improve such performance (Schmidt and Navarro 1991).

Such information is a basic prerequisite to identifying relevant intervention points within the system, including research opportunities and prioritized objectives from the perspective of different disciplines, individually or in combination. Experience so far suggests that it is a useful tool that can be used in oilcrops and, most probably, with other commodities as well.

PCSR, as conceptualized by VOPS (K), has six steps (see Figure 2.3.1). These steps illustrate the stages of study necessary to understand a commodity system. For the vegetable oil/protein system in Kenya, a basic diagram illustrating the different components that had to be studied in order to understand the problem areas within the subsector was developed (see Figure 2.3.2). Although other countries are encouraged to follow this structure, modifications can be made to suit each country situation. (For further reading to understand this process, see Theora, page 51).

Why PCSR Is Relevant to Other Countries

PCSR, although developed in Kenya, is widely transferable, sometimes with modifications, to suit conditions in different countries or other commodities. So far, it has

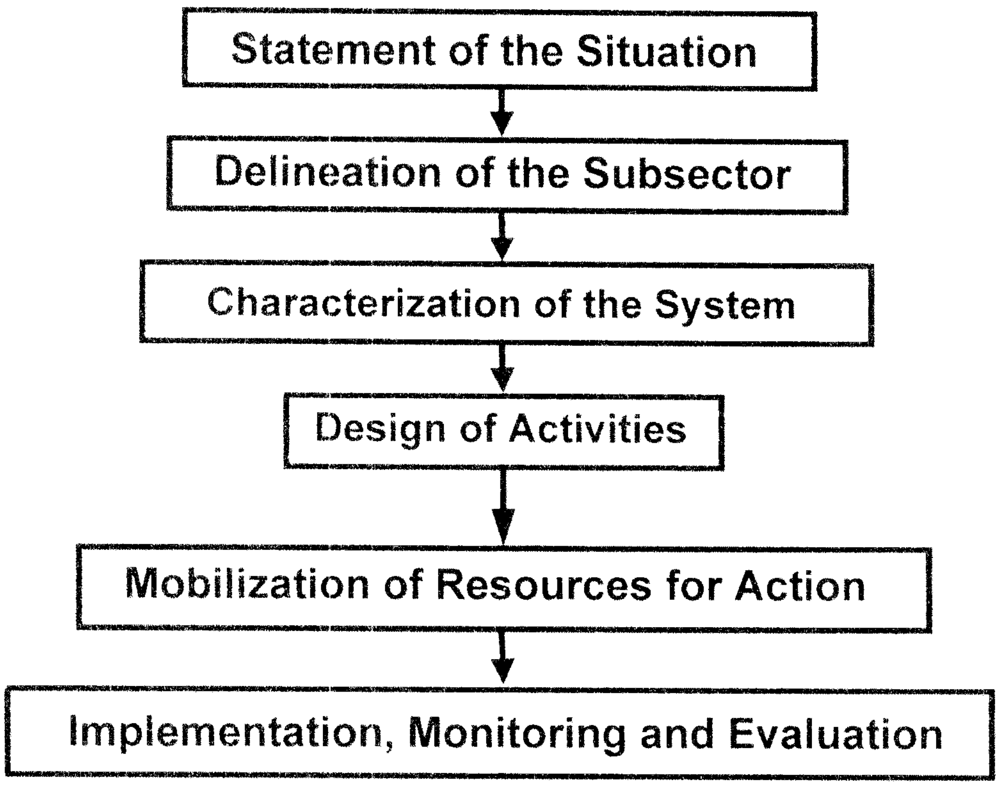

Figure 2.3.1: The Six-step Approach to PCSR (As Used by VOPS-Kenya)

proved a useful tool in creating awareness among different people with an interest in a particular commodity sector. Its holistic concept makes it a valuable tool in problem-identification within a subsector. In Kenya, its application has resulted in considerable breakthroughs in problem identification in the oilcrops subsector. This has led to creation of awareness and to informed decisions in attempts to remove constraints. A number of satellite projects have been established to further research in understudied areas. PCSR is complementary to Farmers System Research (FSR), which looks at interactions between crop and other farm activities. It recognizes that farmers and researchers are not the only arbiters of commodity technology, as consumers and middlemen also have a role to play. The FSR focus on production technology assumes that production constraints, as distinct from marketing and utilization constraints, determine the growth in commodity supply, and that production research will have the greatest impact. Lynam and Janssen (1992) argue that technology design should ensure compatibility between producer, processor, and consumer requirements. It should result in a bias in favour of small-scale producers and low-income consumers. PCSR helps meet these technology-design requirements.

The Research-Capacity Transfer Process

Selection of Countries

Zambia and Tanzania were chosen as the principal areas where PCSR was first to be applied in oilcrops subsectors outside Kenya. The two countries invited AGREF to help them apply the PCSR approach. As demonstrated in Figure 2.3.3, before a country implements PCSR, it is important to ensure the existence of a national interest in the subsector's development. The commodity to which PCSR is to be applied should be one of the country's priorities for development.

Zambia and Tanzania are among the countries with the lowest per capita edible-oils intakes in the world. In common with many African countries, they also have had foreign exchange problems; even when world prices of edible oils were at their lowest, these

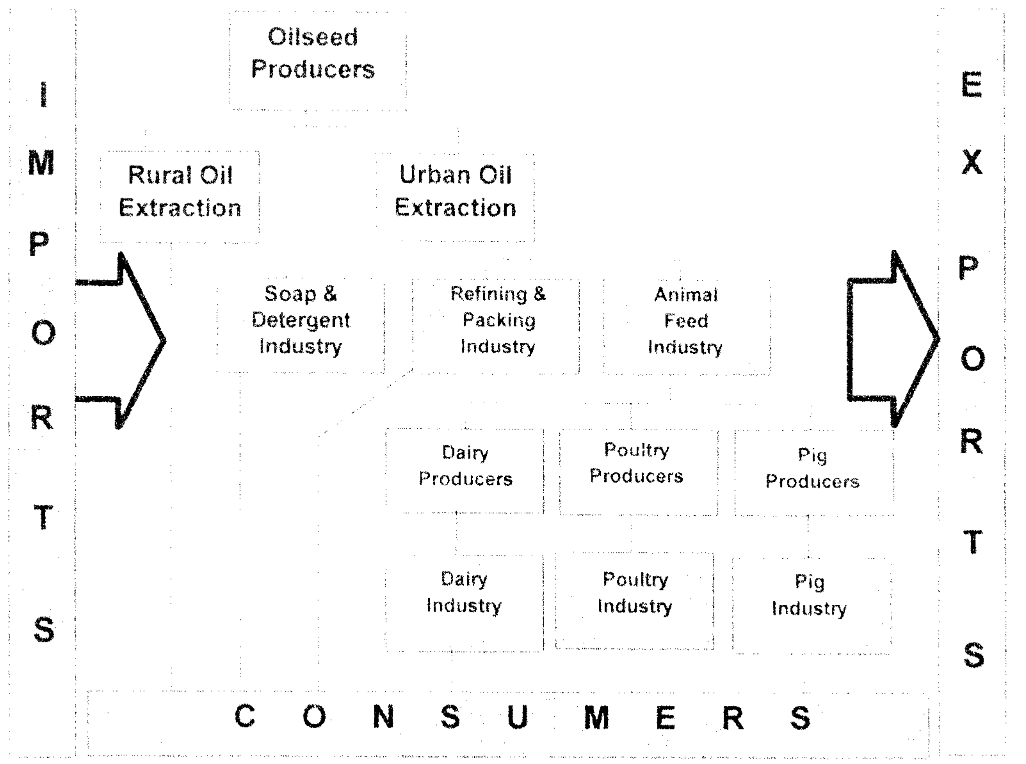

Figure 2.3.2: Vegetable Oil/Protein Subsector Basic Diagram

Source: Zulberti 1991.

countries hardly could afford importation. The little oil that is imported benefits minority urban populations (in the case of Zambia, a large, highly urbanized minority), leaving the majority in the rural areas with little or, often, no oil at all. This is mainly due to distribution and affordability problems. As national teams apply PCSR, they should be able to identify key pressure points that, when addressed, will result in the fastest and most sustainable improvement of the oilcrops subsectors in their countries.

Leadership/Championship

The PCSR process requires a champion or leader with clear interest in the subsector. Such a leader should command respect from the government and from people in the subsector. He/she should be self-motivated and interested in the PCSR process and should have managerial skills, the ability to influence and interact with people, and a convincing manner. This person should be identified from within the subsector, as he/she becomes the link between various people in the region with similar interests. He/she should ensure that work in the subsector is successfully carried out, serve as a coordinating link by calling regular meetings, and make sure all the people in the subsector are involved in the PCSR process. He/she should ensure that these people share their concerns and chart out the direction of the work process. The person or group becomes the repository and main user and disseminator of the updated knowledge about the production-to-consumption systems (PCS) approach. The person should guide the formation of a strong PCSR team to carry out the PCS process. Such a team should be multidisciplinary and composed of energetic and committed people willing to make changes in the subsector.

AGREF made several fact-finding missions to Zambia and Tanzania and held discussions with key people in the government, private sector, and research institutions and with processors and producers, so as to get their impressions of the countries' oilcrops subsectors. This procedure helped to identify in each country a group of concerned people who understood the VOPS subsector.

Formation of a representative group in the subsector was encouraged in each country. The process involved talking with people individually and impressing upon them the need to come together and share their concerns. These groups were to be formed in

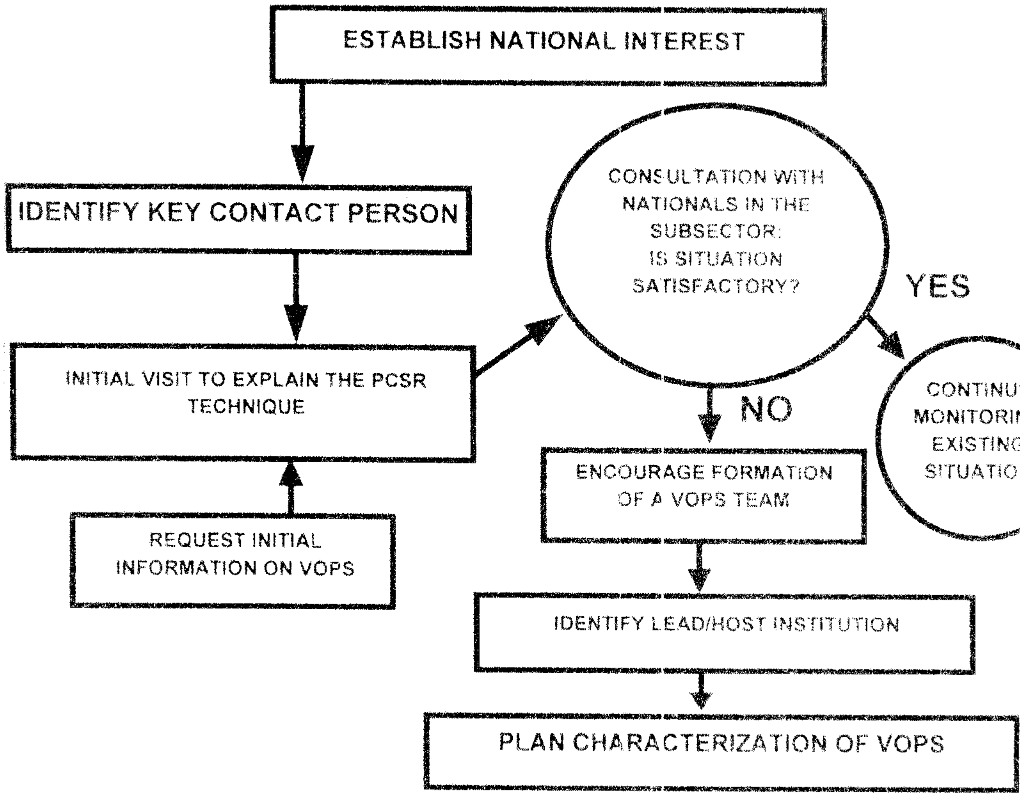

Figure 2.3.3: Introducing the PCSR Approach in a Country

conformity with PCSR requirements, i.e., with each group of concerned people represented. Once such a group formed, the PCSR process was demonstrated using slides and other visual materials developed by Egerton University.

Host Institution

A leading institution to coordinate the PCSR effort in the transfer country also should be identified. This institution should have the needed scientific manpower and facilities and display a keen interest in promoting the subsector. Such an institution can play the role of leader as well as host for the project, as is the case with the Tanzania Food and Nutrition Centre (TFNC). In Zambia, the Oilseeds Industries Liaison Service (OILS) plays the role of leader, while the Preferential Trade Area (PTA) organization plays the role of host.

Figure 2.3.3 shows the different stages in introducing PCSR to a country. The first task is to establish the existence of national interest in promoting the subsector, followed by identification of a key person who can be relied upon to promote the interests of the subsector. This person or group of people should be interested in the PCSR process

Responsibilities of the Host Institution

The host institution in each country is expected to be conversant with the PCSR approach to commodity research and serve as a source of information for all actors in the subsector. In this regard, AGREF proposed to sponsor two candidates from each country for a two-week PCSR course to be conducted at Egerton University in early September 1992 to enable the participants to draw upon the VOPS (K) team's wealth of experience.

The lead institution should show willingness to do something to improve the vegetable oils subsector, preferably through activities such as bringing people together and facilitating contact between different players in the subsector.

The institution also should assume the coordinating role in the various stages of production-to-consumption systems research. These stages are problem delineation, characterization and design of constraints removal. Thus it should organize collection and abstracting of the literature to come up with a national reference document on the oilcrops subsector.

The lead institution should supervise documentation and national reporting of findings including obstacles encountered in implementing the PCSR programme as designed in the national context. Such reports should be copied to AGREF, so that any innovative findings can be shared with other countries.

The lead institution should organize a committee that will ensure that the PCSR implementation process runs smoothly by calling regular meetings to review progress. It also will also organize national workshops whenever feasible.

The lead institution will liaise with AGREF for receipt and channeling of funds for the national PCSR process. It will make a financial report, accompanied by a quarterly technical report on progress.

These responsibilities are spelled out in a Memorandum of Understanding with AGREF.

Implementing the Transfer Process in Practice

Zambia

Problem Identification

In September 1991, Zambia invited AGREF to look at the vegetable oils problem in the country. Zambian oilcrops projects had been examining the problems for a long time, but the projects lacked a forum for sharing their concerns and experiences, thus breeders were working alone, agronomists by themselves, and so forth. This created confusion in the sector about the key problem areas. On visiting the country, and after holding discussions with a full range of individuals and groups in the PCSR spectrum, AGREF confirmed the existence of a problem.

Various groups in the subsector were willing to come together in an internal oilcrops network. Initially, some people were apprehensive about working together; some viewed the others as rivals and could not understand how they would benefit from working together. Later, as AGREF demonstrated the PCSR approach and its uses in identifying and removing areas of constraint, which could improve the whole subsector, they realized the benefits of working together.

Identification of the Lead Institution

The national oilcrops interest groups in Zambia were determined to form a national umbrella group that would be a linking institution. A few months after AGREF's visit, they formed the Oilseeds Industries Liaison Service (OILS) secretariat, with representatives from each interest group, to coordinate oilcrops activities in Zambia. This national organization is composed of people and organizations involved in the oilseeds subsector: government, producers, processors and consumers. OILS already has been incorporated under Zambian law. Members have agreed to pay a membership fee to keep the organization running.

The Zambian VOPS project, launched in July 1992, targets the oilcrops subsector through OILS, whose formation was encouraged by AGREF. The Preferential Trade Area for Eastern and Southern Africa (PTA) is the local host institution of this project through a Memorandum of Understanding with AGREF. Under the MoU, AGREF channels funds in support of the project through the PTA. OILS, just formed and as yet without offices, has been provided with office space and other facilities by PTA. AGREF has agreed to provide funding for OILS's coordinator after the organization agreed that the industry's first priority would be to carry out PCSR diagnostics in Zambia.

The PTA Linkage Advantages

PTA's involvement with the Zambian PCSR project offers several advantages:

- Its intergovernmental nature and specific Eastern and Southern Africa operational mandate, which coincides with AGREF's own operational area, and
- The Memorandum of Understanding between PTA and AGREF to cooperate in regional agricultural endeavours. A specific Letter of Agreement between PTA and AGREF, developed jointly with OILS for the purpose of facilitating the PCSR approach in Zambia, was signed on 17 July, 1992.

Although the project receives most of its donor funding from IDRC, AGREF is endeavouring to increase its own contribution as well as encouraging other organizations and institutions to participate. Having a broad financial base is important to ensure that the project is institutionalized. In this regard, the OILS example in Zambia is especially encouraging since the industry plans to ask its members to pay a levy to ensure sustainability. In Zambia, the Agribusiness and Management Support Project (ZAMS), AFRICARE, and the Ministry of Agriculture have shown keen interest in participating. PTA, which has given material and moral support to PCSR, is important in the process due to its regional scope. The PTA is particularly interested in rural/farm-based processing.

Problem Delineation

The strategy for problem delineation has been worked out in detail by concerned parties in collaboration with AGREF, which has made funds available. The actual process was slated to start in October 1992 after two of its nationals attend the course on PCSR at Egerton University.

As part of the agreed strategy, AGREF provided funds to employ the OILS national coordinator, who will be leading the PCSR effort in Zambia. Under the current project, available funds can finance the PCSR implementation programme in the two countries up to the characterization stage (Second National Workshop). A complete programme of events up to the Second National Workshop is presented in Figure 2.3.4 and Table 2.3.1. In reference to Figure 2.3.4, the Zambian project is in the initial stages of Box III.

The project coordinator is setting up the programme for the diagnostic stage of the project. The first task is to collect literature and produce an abstract to find out what is

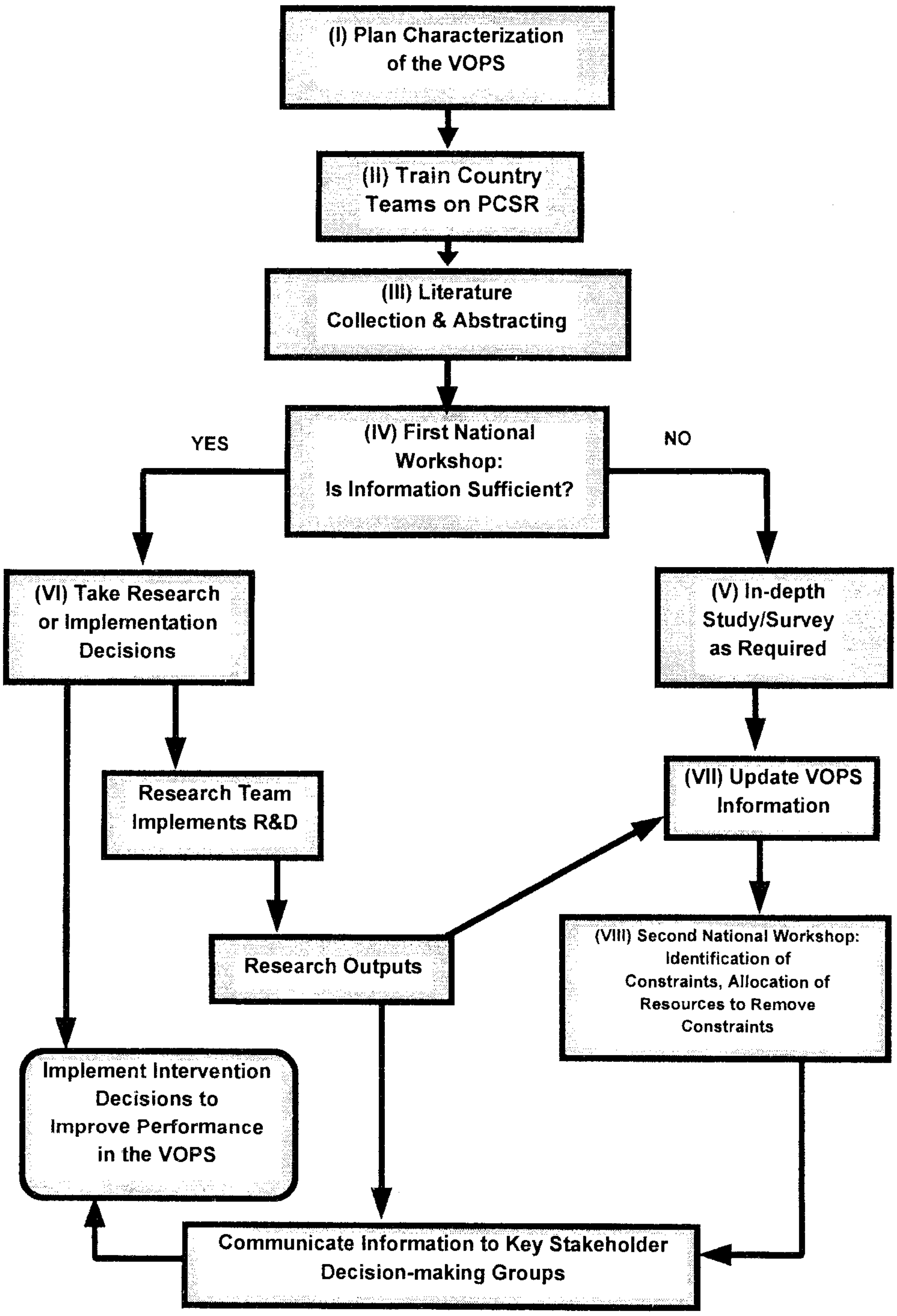

Figure 2.3.4: PCSR Research Capacity Transfer Process

known about the subsector. After four months' time, a First National Workshop should be held to deliberate on the findings and map out strategies for the next stage of implementing PCSR.

Table 2.3.1: Schedule of Activities to Start The PCSR Process

Activity	Months			
	1-3	4-6	7-9	10-12
1. Literature Review	XXXXXXXX			
2. Abstracting & Reporting	XXXX	XXXX		
3. First Workshop		X		
4. Diagnostic Visits and Reporting			XXX	
5. Second Workshop				XX
6. Programme Proposal				XX

Tanzania

Problem Identification

AGREF was invited to Tanzania in January 1992 and held discussions with a wide spectrum of concerned individuals and groups including government institutions, producers, processors, others in the commercial sector, and consumers. At the time, Tanzania had ongoing vegetable-oil projects, especially in rural oilseeds processing. The country also had several agronomic oilcrops programs dealing with specific crops. Research results from these programs indicated that the country has great potential to grow a variety of oilcrops. Despite these efforts, production of oilseeds remained low, and oil and fat intake in the country was among the lowest in the world. Tanzania can not afford to import cheap oil from the Far East due to foreign-exchange constraints. Thus there was a need to look at the problem from a different perspective.

Once the PCSR process had been demonstrated in Tanzania, evidence of a problem was strong, but an integrated approach was needed to address the components of the subsector in order to identify constraints. This led to initiation of the PCSR process in Tanzania.

The next step was to identify a leader in the subsector to coordinate the PCSR process in the country.

Selection of a Lead Institution

In selecting a national institution to host the project, each institution's scientific equipment, administrative personnel, and physical facilities were considered to ensure that the project operates properly. This institution is to serve as the focal point for PCSR in the country, acting as AGREF counterpart and coordinating in-country diagnostic work. Tanzania Food and Nutrition Centre (TFNC) agreed to act as the lead institution and house the project's secretariat. As the institution charged with food and nutritional affairs in Tanzania, TFNC is competent and has the manpower and organizational and research skills to handle the project.

TFNC and AGREF signed a Memorandum of Understanding covering implementation of the PCSR approach to oilcrops in March 1992. Funds were available to start the programme within a month. The project was officially launched in April 1992 and had funds to cover the first three stages (Statement of the Situation, Delineation, and Characterization of the Subsector) in the VOPS(K) PCSR implementation programme (shown in Figure 2.3.1).

Disbursements to the national programme are made on a quarterly basis, following a preview of PCSR work to be done in the quarter ahead and a detailed review of work done in the previous quarter. AGREF management has made a number of visits to both Tanzania and Zambia to launch the country programs and supervise their work.

A National Steering Committee has been formed in Tanzania under the chairmanship of the Ministry of Agriculture and Livestock Development. The committee has three key functions as stipulated under its terms of reference. These are to

- Coordinate all VOPS activities,
- Advise on policy issues related to VOPS, and
- Prioritize actions for implementation.

Problem Delineation

The programme in Tanzania started about six weeks after receipt of funds and has consisted largely of data collection on the subsector from all over the country. Information is being compiled in an easily retrievable form and will be circulated as widely as possible for comment before the First National Workshop.

TFNC will lead the workshop and assist participants in identifying gaps in the material collected so far that indicate a need for further detailed study. The outcome of the workshop will be subsector delineation. Workshop participants also will discuss and agree on the next stage of PCSR diagnosis, subsector characterization.

This stage will be characterized by an in-depth diagnostic study and fieldwork. In this stage, about seven groups will be formed, each comprising four scientists, to study different components of the subsector. Each group will draft its own questionnaire, which will be discussed and agreed upon by the groups to ensure consistency. Following the field visits, each team leader will coordinate data analysis and report writing to ensure that participants follow the agreed format. Each report will be edited and sufficient copies produced and distributed for comment before the Second National Workshop.

The Second National Workshop will discuss the seven reports and adopt each group's findings. It will discuss and agree on the actions needed to remove the constraints identified and consolidate areas of strength. The workshop will agree on an action plan, starting with a prioritized listing of concerns and selection of individuals to prepare detailed proposals for removing each constraint.

Lessons Learned

In Zambia, widely divergent and often competing groups are willing to come together in the vegetable oils subsector and even pay to be members of the promotional group, which has a rotating chairmanship.

In both Zambia and Tanzania, the project and the proposed approach appear to have filled a latent need for those involved in the industry to come together to help it grow. Considerable lead time is required to get started, even in countries such as these where a national commitment to promote the subsector already existed.

Communications problems are playing a prominent role, even in Tanzania, which is very close to the AGREF operational base in Kenya. For this reason, much attention needs to be paid to ways of easing transmission of information. AGREF is considering investing in an E-mail system, which appears to be considerably cheaper than either telex or facsimile communication.

The Oilcrops Subsector in Tanzania and Zambia

Tanzania and Zambia, like Kenya, have good potential for increasing oilseeds production through the introduction of higher-yielding varieties and introduction of oilcrops to marginal or new areas. The three sister countries have low oil intakes per capita by world standards. Oil intake in the rural areas in all three countries is far below that of urban areas. This discrepancy is caused by differences in product availability and affordability in rural and urban areas. Zambia and Kenya are classified as countries with low oil intake and high oil importation, while Tanzania is a country with low oil intake and low oil import (Riley 1992).

Zambia

Until 1986, sunflower was the main oilseed crop grown in Zambia, mainly by small-scale farmers (80 percent). The production of sunflower has been fluctuating due to price instability. In contrast, prices of soybean and cottonseed meal have continued to be attractive. As a result, soybean hectarage increased from 4,000 in 1986 to approximately 50,000 in 1992. The Department of Agriculture produces a quarterly newsletter on soybean development in Zambia. This newsletter is meant to disseminate information on growing and utilizing the legume. In June 1991, the Posts and Telecommunications Corporation of Zambia produced four postage stamps bearing promotional messages about soybean. Lint Company of Zambia (LINTCO) has a soybean team that promotes utilization. Recently, the team produced educational materials for village training that tell about soy nutrition and cooking methods.

Production

The four major sources of edible vegetable oil in Zambia are cottonseed, groundnut, sunflower, and soybean. Their contribution to the national need is as follows: cotton, 6 percent; soybean, 17 percent; and sunflower, 15 percent. Sunflower and soybean have the greatest potential to become major sources of edible oil in Zambia. Oilseeds processing provides one-third of the 36,000 metric tons per annum required by the nation. To meet its edible oils demand, Zambia needs to produce at least 60,000 metric tons of soybean (12,000 metric tons of oil), 94,000 metric tons of sunflower (23,000 metric tons of oil), and 2,200 metric tons of oil from cottonseed.

Groundnut is second in importance to maize for small-scale farmers and is mainly grown for home consumption. Surpluses are sold in local markets. Only insignificant quantities go for oil extraction. Yields are low; for example, 85 percent of farmers harvest less than 500 kg of groundnuts per hectare. Low yields usually are attributed to competition for labour from other crops, especially during planting, weeding, and harvesting, and to insufficient financial resources, resulting in nonuse of improved seeds and fertilizers.

Production Constraints

Lack of organization and institutional support have been cited as the main constraints to oilseeds production in Zambia. Credit facilities for inputs required to produce hybrid varieties also are inadequate. In addition, availability of improved seed at planting time is said to be erratic. This makes farmers use retained seed for planting, resulting in poor yields. The use of retained seed for planting instead of seed recommended by ZAMSEED is estimated to result in 20 percent lower yields. Low producer prices for oilseeds, coupled with inefficient marketing channels, are other factors that negatively affect seed production. Sunflower generally is seen only as a cash crop and, as such, is assigned low priority over food crops. Lately, with market liberalization, product prices have improved substantially.

Disease problems, e.g., fungus (*Pyrenochaeta,* or red leaf blotch), mainly affect soybean.

Poor farm practices such as late planting, poor weeding, or no weeding, coupled with poor postharvest handling, are also a major cause of low productivity. For example, late planting is estimated to reduce yields as much as 50 percent and oil content by up to 10 percent. A Ministry of Agriculture, Food and Fisheries (MAFF) study found that yields of sunflower declined an average of 15 percent for every two weeks' delay in planting (RONCO 1991). Failure to weed could reduce yields by 30 to 75 percent. Low plant populations caused by improper seed spacing is another cause of poor oilseed yields in Zambia (RONCO 1991).

Processing

There is concentration of large-scale expelling and/or refining in main urban areas, with most plants operating below 30 percent of their installed capacity. Domestic production of edible oils is dominated by two parastatal corporations, Refined Oil Products (ROP) and Premium Oil Industries (POI), which hold 70 percent of the national crushing capacity (Deloitte 1987). The existing processors have a total sunflower-crushing capacity of 112,000 metric tons (30,000 metric tons of oil)—90,000 metric tons of which capacity belongs to Premium Oil—and a soybean-crushing capacity of 60,000 metric tons. Premium Oil operates at about 25 percent of its installed capacity. The national installed crushing capacity is 50,000 metric tons of oil per annum, which could more than satisfy national demand.

Village-level Oil Processing While virtually all vegetable oil processed by large- and medium-scale industries is consumed by urban and periurban dwellers, the rural consumer, who is the oilseed producer, usually is left out. Village and small-scale oil processing remain the most viable options for increasing the availability and affordability of cooking oil in rural areas in Zambia. Village oil processing puts great emphasis on sunflower, since it is more adaptable to ram-press technology and because oil extracted from it can be used for cooking without further processing. Rural processing ensures that a good portion of edible vegetable oils remains in rural areas and also stimulates both sunflower cultivation and interest in the development of improved seed varieties with high oil content.

A number of NGOs are involved in promotion of small-scale processing in Zambia. USAID, the major financier, has contracted with ZAMS to develop small-scale processing. There are three press systems available in Zambia for rural oil extraction:

- Royal Tropical Institute (RTI) system, or spindle-type press,
- Bielenberg ram-type press, and
- Simon Rosedown/Moparco small-scale screw expeller.

Of the three rural-adapted presses, the ram press has proven most suitable for small-scale oil production after being tested for

- efficiency,
- economic performance,
- manageability,

- repair and maintenance,
- possibility of local manufacture, and
- savings of foreign exchange.

The Bielenberg ram press was introduced in Zambia in 1988 from Tanzania by AFRICARE. Since then, the Technology Development Advisory Unit (TDAU) of the University of Zambia has modified the press to suit the hard-hulled sunflower commonly grown. Based on the estimate that a family needs 40 litres of oil per year, the ram press can serve about one hundred families. So far, it has sold sixty-seven ram presses in the country, but this technology is not yet ready for widespread dissemination, as tests are still progress.

Further research is focused on the possibility of adapting the ram press to other seeds. In Zambia, the original ram press is being tested with groundnut, and 40 percent efficiency has been achieved. The newer Camartec press, developed in Tanzania, is said to be efficient for sesame-oil extraction and is under extensive testing.

So far, two ram presses modeled after the new Camartec press, which cost only US$ 100 each, have been produced in Zambia by the Kaleya and Lutanda companies and are undergoing tests to determine their suitability for use in village settings. This indicates that the capacity for commercial manufacture of village-level technology is available.

There are also attempts to develop an ox-driven ram press. The animal-powered press was developed by the Village Oriented Development Program (VODP) with the Diocese of Chipata and the Institute for International Cooperation (Austria). Two of these presses have been produced and another sixteen should be operational by 1995 (RONCO 1991). The ox-driven press costs US$ 4,400 and has an output of 6 to 8 liters of oil per hour, depending on the seed used. Appropriate seeds for this press are sunflower and groundnut.

In time, it will be necessary to develop a medium-scale production unit to supply a wider area and expand daily extraction capacity. It is important to note that oil expellers in Zambia have no problem disposing of either their oil or their cake in rural areas, as consumers insist on availability and affordable prices.

Processing Constraints

Seed impurities, especially sand, increase wear and tear on presses (RONCO 1991). Zambian Agricultural Trading Company Limited (ZATCO) estimates that for the seed it buys, 15 to 30 percent by weight is trash. The performance of the locally assembled ram press is also rated as poor. The amount of oil extracted is sometimes low due to the poor seed quality. Lack of skilled service and/or repair personnel, irregular availability of spare parts, and a poor working environment are some of the problems that affect large-scale processing firms in Zambia.

Marketing

Oil processors in Zambia are willing to pay a premium for high-oil-content soft-hulled seed. Some ram press owners test seed before purchase and offer higher prices for high-quality seed. One of the leading edible oil-producing companies in Zambia, Premium Oil Industries, also pays higher prices for hybrid seed. This is a positive step, as it encourages farmers to adopt hybrid seeds with higher oil content. However, the industry's efforts are hampered by unreliable supply of superior seed to rural farmers, making them retain local seed for planting.

Like many developing countries, Zambia imposed price controls on most of its products, including vegetable oil. However, in 1991 it decontrolled the price of vegetable oil. Until then, vegetable oil prices had been kept artificially low, sparking cross-border smuggling to neighbouring countries, where prices were almost 300 percent higher. Following decontrol, prices within Zambia increased by 200 to 300 percent. Current prices are now slightly below those of Tanzania. The following is a summary of oil price changes since June 1988:

	June 1988	June 1991	December 1991
Price/5 liters (in kwacha)	K 49.5	K 750	K 840

The 1992 sunflower price is estimated at K 1,100 per 50 kg bag (K 22/kg) (RONCO 1991).

The market for cooking oil already exists, but the market for seedcake as an ingredient for animal feed for use by small-scale farmers has to be developed. An intensive livestock and poultry industry has developed near urban centers in Zambia. As a result, there is strong periurban demand for oilmeal, and prospects for soybean cake remain good in these areas. (Some soybean also is used in formulating baby formula.)

Point of Sale

Point of sale is principally point of production. Local shopkeepers buy extracted oil in small lots of 5 to 20 liters and sell to consumers in very small (100 ml) cups for as much as K 30. This translates to K300/liter (RONCO 1991).

Farmers who extract oil for their own use have no problem disposing of surplus oil. For example, in one case, some women in Nachengwa sold their surplus oil in Mazabuka Market for K 150/liter and to their neighbours and among themselves for K 100/liter. In Gwembe Valley, where throughput per ram press is between 50 and 200 kg per day, extracted oil is sold at K 150/750 ml—but little use is made of the cake. In other areas, small oil expellers have no problem selling either oil or cake.

As long as prices of oilseeds remain attractive, and if seed-production problems can be overcome, then prospects for increasing sunflower production are good.

Feed prices depend on type. For example, dehulled sunflower meal sells for K 14/kg and cottonseed meal for K 9.5/kg at the factory gate at Supa Oil in Kabwe (RONCO 1991).

Consumption

Demand for vegetable oil in Zambia now stands at 36,000 metric tons per year, with urban per capita intake at 36.3 g/day. More than 60 percent of Zambia's vegetable oil and a smaller proportion of its cake is imported at an estimated cost of US$ 22 million (US$ 16 million for edible oil and US$ 6 million for cake) per year.

The Feeds Industry

The stockfeeds industry in Zambia requires about 51,200 metric tons of cake annually, which could be derived from the three major oilcrops that provide the following quantities of stockfeed: 36,000 metric tons solvent-extracted soycake, 9,600 metric tons solvent-extracted sunflower cake, and 4,800 metric tons cottonseed cake. Total demand for feed is estimated to be 160,000 metric tons annually. Only cotton has matched the requirement (Lubozhya et al. 1990).

The advancing age of production plants, coupled with a shortage of foreign exchange for purchase of essential feed ingredients, are the main constraints on the feed industry. Unavailability of good-quality vegetable protein soycake and sunflower cake in sufficient quantities is the other limiting factor.

Research

Sunflower hybrids with yield potentials as high as the world's best have been developed in Zambia. Research also has led to oil-content improvement in sunflower, from 25 percent in the Chilanga Black Giant variety (1976) to 40 percent in Kayula (Chilanga hybrid or CH 311) (RONCO 1991). Adoption of these varieties has been hampered by seed-production problems, among others. Agronomy research has demonstrated that timely planting with row arrangement and adequate plant population would double yields and improve oil content by as much as 10 percent. Strong research on soybean also has had a tremendous effect on soybean yields under experimental conditions.

Tanzania

Situation

Tanzania has good potential for increased oilseeds production through a combination of high yields, improvements in farming practices, and expanding production to new areas. Production has remained low due to lack of high-yielding oilseeds, high incidence of disease, insect pests, and poor husbandry practices such as late sowing, low plant populations, poor weed control, and poor postharvest seed handling. Inadequate technical packages also contribute to low production.

Production

Cottonseed remains the single largest source of vegetable oil, accounting for about 60 percent of cooking oil in the country. However, its production decreased from 136,000 metric tons in 1969 to 88,000 metric tons in 1986 as a result of the above problems. Sunflower, groundnut, and sesame are the major locally consumed oilseed crops in Tanzania.

Processing

Tanzania has about thirty-five large oil mills located in urban areas. These mainly serve the formal market and operate at very low capacity (about 30 percent) due to lack of seed because of poor roads badly in need of repair. The oil produced ranges from 15,000 to 35,000 metric tons per year. These mills have experienced management problems as well as old-equipment bottlenecks.

In the last five years, since the introduction of the ram press, rural production of manually extracted oil has increased. Currently, about five hundred ram presses have been distributed and are operating in Tanzania. The ram press has been embraced enthusiastically; its further promotion in rural areas is being encouraged in nineteen districts, largely by Lutheran World Relief and the Small Industries Development

Organization (SIDO) under the Ministry of Industries. Sunflower production reportedly is increasing where ram presses have been introduced.

Oil prices in Tanzania are so high that local oil extraction is quite profitable. There are also reports of a profitable export of oilseed cake.

Marketing

In the past, state-controlled producer prices maintained below true market prices have been the major marketing disincentive in Tanzania. This situation led to the development of a black market. At one time, an estimated 70 to 80 percent of food staples was marketed through unofficial channels. Marketing of oilseeds and edible oils is done by cooperatives and parastatals and, increasingly, by the private sector. With improving producer prices, the main constraints in marketing will be seed availability, the poor transport network, and low world prices for imported oil. The price of seeds also doubles between farm gate and oil mill, mainly due to cooperative marketing costs. The sales tax on edible oils stands at 30 percent. Some industry inputs are taxed at rates ranging between 25 and 50 percent (Ministry of Trade and Industry). Importation has been liberalized in Tanzania, and anyone with access to foreign exchange is free to import any amount of oil.

Consumption

Per capita intake of oil is estimated at 3.66 kg (Ministry of Agriculture and Livestock Development 1987) per annum. Demand for edible oils is estimated at 46,000 metric tons per year; out of this, 20 percent is supplied by local mills, another 20 percent is supplied by home extraction, and the remainder is met through imports (Ministry of Industry and Trade 1989). The demand for edible oils is projected to grow at 6 percent per annum, resulting in consumption of 63,000 metric tons in 1994/95 and 84,000 metric tons in the year 2000 (Ministry of Industry and Trade 1989).

A number of organizations promote oilcrops in Tanzania. These are the Small Industries Development Organization (SIDO), Lutheran World Relief (LWR), and Appropriate Technology International (ATI), among others.

The Feeds Industry

Tanzania has a high livestock population, mainly supported through open grazing. With increasing urbanization and population growth, the demand for livestock production certainly will increase as the amount of open grazing land decreases. Increased supply of livestock products will therefore depend largely on availability of feedcake. The development of the oilseeds subsector provides an excellent opportunity to meet this need.

The demand for oilcake is 510,000 metric tons per year. Only 75,000 metric tons are produced locally, although the country has installed capacity to produce 384,000 metric tons per year. Available literature on feed production indicates underutilization of existing capacity and also production of poor-quality cake that has a very high oil content. In intensive dairy-farming areas, especially in the north, oilseed cake is reported to be at least as profitable as oil.

Research

Until its dissolution, the Tanzania Agricultural Research Organization (TARO) was charged with agricultural research and policy formulation in Tanzania. It started a bilateral research programme, funded by the Tanzanian government and the United Kingdom through Overseas Development Assistance (ODA), at Naliendele in 1978. Its objectives were to identify and develop varieties of sesame, groundnut, and sunflower suited to Tanzanian growing areas with high yield potential, good resistance to diseases, and desirable agronomic characteristics (TARO 1988). It succeeded in developing a number of seeds with high and stable yields including Bora and SSBS7 (sesame) and Nyota and Johari (groundnut). Recently, the newly introduced soft-hulled sunflower variety Record, with oil content of more than 40 percent, has been released in Tanzania. It has been widely accepted by farmers in conjunction with the ram press.

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2.4

The Vegetable Oil and Protein System in Nepal

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National Oilseed Research Program, Sarlahi, Nepal

Oilseed crops are important in Nepal as they generate both oil and income. Nepal was self-sufficient in oilseed production through the 1970s. After the early 1980s, the scenario changed, and Nepal started importing oils as well as oilseeds. Oilseeds production increased during this period, but due to population growth, the consumption of oils and fats did not. His Majesty's government realized the situation and established a National Oilseed Development Programme (NODP) in 1986, at present called the National Oilseed Research Programme (NORP). The programme is based at Nawalpur in Sarlahi District in the southern part of the country. The main objective of this programme is to increase oilseeds production, mainly through proper research.

The International Development Research Centre (IDRC) started supporting oilseeds research on 15 July, 1988. The vegetable oil and protein system (VOPS) study was a part of IDRC's support to NORP. This study was carried out between November 1991 and June 1992 with the help of three consultants. Rapid rural appraisal (RRA) and rapid marketing appraisal (RMA) were the main methods applied to collect information on different components of the VOPS. Group meetings were also organized to verify the information collected from individual farmers during field surveys. The consultants discussed the methodology in a steering committee meeting that took place before the field survey, to which specialists from different fields of VOPS were invited. The draft report also was discussed in the second steering committee meeting, to which a concerned scientist from the National Planning Commission also was invited. Other invitees were from the government, industry/processing, and research. In brief, the findings of the VOPS study are presented below.

Consumption

The many components of the vegetable oil and protein system include consumption, production, oilcake/oilmeal, export, import, and marketing. VOPS policy is also an important component that, by and large, affects the whole system. Consumption is considered to be the first component in the system.

As the report on the VOPS study indicated, the average dietary consumption in Nepal is too low, especially in rural hill areas as well as in the *terai*. A suggested intake of visible oils and fats is 10 percent of calories, which works out to 9.1 kg per capita per year (FAO 1988). The study found that average visible fat and oil intake in Nepal is only 2.6 kg per capita/annum. In spite of huge importations, the consumption level has remained the same in the last few years. Per capita consumption in 1984 and 1992 are given in Table 2.4.1, which makes clear that overall consumption is lower in rural areas and that two studies are in agreement on this.

Table 2.4.1: Comparative Per Capita Intake of Vegetable Oils Between 1992 and 1984

Source	Rural High Hills and Hills	Rural *Terai*	Urban Hills	Urban *Terai*
NRB (1984)	1.62 kg	2.61 kg	3.24 kg	3.15 kg
Field Survey (1992)	1.38 kg	2.13 kg	3.11 kg	2.81 kg

Source: Field surveys (1984) and Nepal Rastra Bank Household Survey (1992).

Production

Oilseeds production is also one of the most important components of VOPS. During the study, production, diseases/pests, and cropping-patterns constraint were identified. The official data collected, given in Table 2.4.2, indicates a trend of increasing oilseeds area and production.

Table 2.4.2: Area, Production and Yield of Oilseed Crops

Year	Area ('000 ha)	Production ('000 metric tons)	Yield (kg/ha)
1975/76	113	68.5	606
1985/86	138	78.4	568
1989/90	155	99.2	641

Source: DFAMS.

The relative importance of different oilseed crops in terms of area and yield also was stable, and the study concluded that tori (*Brassica campestris toria*) was the main oilseed crop in both hills and*terai*. Maximum area was covered with this crop, and only small areas are occupied by other oilseed crops (see Table 2.4.3).

Table 2.4.3: Percentage of Cropped Land Occupied by Annual Oilcrops Species in Areas Surveyed in Nepal

Ecological Belt	Tori	Rayo	Linseed	Sesame	Soybean	Groundnut	Niger
High hills & hills	4.75	0.08	-	-	0.55	0.04	0.30
Terai & Inner*Terai*	10.29	0.51	2.20	0.91	0.07	0.29	0.20

Source: VOPS Study (1992).

The yield levels of different annual oilseed crops are also given in the VOPS report. See the summary in Table 2.4.4.

Table 2.4.4: Comparison of Yields of Different Oilseed Crops in Nepal (kg/ha)

Crops	Yield (1992)	
	Hills	*Terai*
Tori	383	558
Rayo	425	485
Linseed	-	244
Sesame	-	389
Groundnut	900	860
Soybean	650	530
Niger	338	310

Source: VOPS Study (1992).

The labour requirement and net profits (rupees/ha) from oilseeds production are given in Table 2.4.5. The data indicates that maximum labour was needed for groundnut, both in the *terai* and in the hills. Net profit was considerably higher for sesame.

Table 2.4.5: Labour Requirement and Net Profit for Production of Oilseed Crops in Nepal

Crops	Labour (days/ha)		Net profit (rupees/ha)	
	Hills	*Terai*	Hills	*Terai*
Tori	91	94	1,831	4,080
Rayo	-	101	-	-
Linseed	-	52	-	2,023
Sesame	-	111	-	4,788
Soybean	131	-	2,845	-
Groundnut	285	283	6,360	4,290
Niger	81	-	565	-
Sunflower	-	-	-	934

Source: VOPS study (1992).

Marketing of Oilseed and Oilcake

Marketing of different oilseeds and oilcakes differs among areas. Tori in hills is mainly used for consumption, but in *terai* it is also a cash crop. A considerable amount of tori is marketed in *terai*. Similarly, linseed and sesame are also cash crops in *terai* areas (see Table 2.4.6).

Table 2.4.6: Percentage of Marketed Quantity of Oilseeds as a Percent of Oilseeds Production

Ecological Belt	Tori	Rayo	Linseed	Sesame	Soybean	Groundnut	Niger
High hills & hills	6.50	-	-	-	8.70	70	25
Terai & Inner *Terai*	27.70	30	80	82	-	80	56

Source: VOPS study (1992).

The percentage of oilcake/oilmeal traded or retained was also studied. The regional percentage of oilcake traded and retained is presented in Table 2.4.7.

Table 2.4.7: Percentage of Oilcake Traded

Ecological Belt	Traded	Retained	Animal Feed	Retained Manure	Others
High Hills & Hills	37	63	25	23	15
Terai & Inner *Terai*	55	45	23	15	7

Source: VOPS study (1992).

Farmers retained 50 percent of oilcake to use as cattle feed. The remaining amount was used as crop manure and for other purposes. Farmers used cake for manuring millet and rice seedlings. They also used cake for pasting baskets and bins.

Prices, Markets, Import, and Export

The VOPS study clearly mentions several important issues related to prices, markets, and export and import of oilseeds, oil, and oilmeal:

- The prices of imported and refined vegetable ghee and oil have closely followed domestic mustard oil prices but have been cheaper (vegetable ghee 5 to 7 percent and vegetable oil 10 to 15 percent).

- Domestic oil prices in Nepal have followed the Indian domestic price almost exactly. In years past, Indian prices have been slightly higher.

- The domestic oil price in Nepal shows a rising trend, but the world palm oil price has been generally moving downward.

- There are many refining plants working, but their product is hardly found in Nepal, while it is available in shops across the Indian border.

- Officially reported imports of oils and oilseeds have been variable but have increased rapidly in recent years.

- Exports include small quantities of sesame/niger seeds (100 to 2,000 tons to overseas countries) and linseed (up to 2,000 tons to India) has been exported. Up to 15,000 tons of oilcake are exported to India.

Policies

Since 1976, His Majesty's government has established a separate National Oilseed Research Programme. This indicates an intention to increase domestic production of oilseeds, increase availability and consumption of vegetable oil, and increase farmers' productivity and profits through oilseed cultivation.

The ban on exporting mustard/rapeseed clearly indicates government concern that domestic production be used to increase domestic oil consumption.

The government has sanctioned very-large-capacity vegetable oil refineries. These refineries run at less than 50 percent capacity. Higher profits per kilogram of oil refined are necessary to keep these units operating; this is possible only through use of imported crude oil, which is becoming cheaper. The amount of oil imported is limited by a quota system set by a government committee. The amount imported has been rising rapidly in recent years.

It is commonly assumed that increased oil imports will increase oil availability and support the oil-refining industry in the country until domestic production can be increased and used as the source of refining oil. The study has shown that the opposite is happening in Nepal. A large part of the product is unofficially exported to India. Increased imports of oil neither lower prices nor increase domestic availability or consumption.

The large allocation of scarce reserves of government foreign exchange is a) sustaining refining industries that replace domestic oil but do not increase domestic consumption and b) discouraging production of domestic oilcrops.

VOPS Model

The study clearly mentions the model (see Figure 2.4.1) showing the whole vegetable oil and protein system of Nepal, which can help explain the linkages between various system components and constraints.

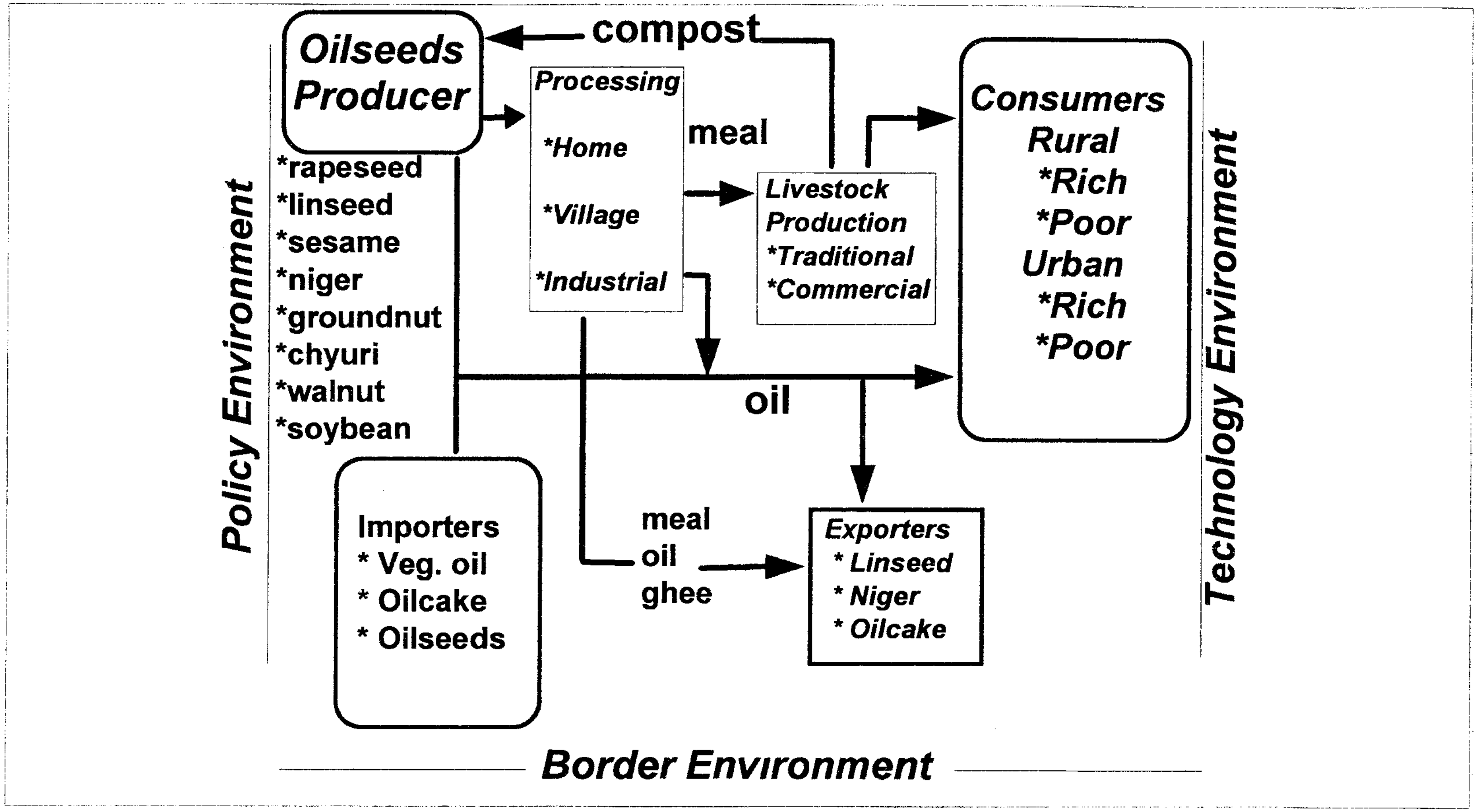

Figure 2.4.1: Identified components of the Vegetable Oil and Protein System In Nepal

2.5

An Integrated Approach to Attaining Self-reliance in Edible Oils in India

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M. Rai

Indian Council of Agricultural Research

In India, groundnut (*Arachis hypogaea*), rapeseed-mustard (*Brassica juncea, B. campestris* [var. brown *sarson*, yellow *sarson*, and *toria*;] *B. napus, Eruca sativa*), sesame (*Sesamum indicum* syn. *S. orientale*), soybean (*Glycine max* syn. *G. soya*), sunflower (*Helianthus annuus*), safflower (*Carthamus tinctorius*), niger (*Guizotia abyssinica)*, linseed (*Linum usitatissimum*), and castor (*Ricinus communis*) are predominantly grown. Except for linseed and castor, all other oilseeds are used primarily for edible purposes. Besides these nine oilseeds, coconut (*Cocos nucifera*) cultivation has long been important. Recently, oilpalm (*Elaeis quineensis*) plantations have been initiated in some pockets. Of more than a hundred oil-yielding forest tree species, a few are exploited for oil production. Apart from these primarily oil-bearing annuals and perennials, other crops (cotton, paddy, maize, etc.) are also available to augment the vegetable oil supply.

Oil and Oilseeds Scenario

From 1949-50 to 1988-89, the annual growth rate of oilseeds production in India was 2.04 percent, while the growth rate of cereals was 2.97 percent. The growth rate of different crops/commodities in different periods is presented in Table 2.5.1. However, the increase in oilseeds yield was only 0.82 percent and for cereals, 1.91 percent. With the establishment of the Technology Mission on Oilseeds (TMO), production went up to 18.46 million tons during 1990-91, compared to 11.27 million tons in 1986-87 (see Table 2.5.2). During 1991-92, production of 19.5 million tons is expected from nine annual oilseed crops. Major gains are due to enhanced yields rather than to area expansion, as in the previous three decades. During the 1980s, the compound growth rate of area and yield of nine annual oilseeds was 2.48 and 2.58 percent respectively, reflecting a good growth in production to the tune of 5.4 percent per annum. Such a spectacular achievement was widely acknowledged, as about 80 percent of oilseeds were grown as rain-fed crops.

Table 2.5.1: Compound Growth Rate of Production of Different Crops and Commodities (%)

Crop/Commodity	1968-1989	1980-1990	1990-1995 (expected)
Rice	2.56	3.24	3.50
Wheat	5.18	4.63	5.00
Pulses	0.61	0.74	0.94
Oilseeds	2.80	5.94	4.00
Cotton	1.83	1.34	2.50
Sugarcane	2.74	2.07	2.50

Source: Indian Council of Agricultural Research.

In India, more than two hundred varieties and hybrids of different oilseed crops are available for commercial exploitation (see Table 2.5.3). Demonstrations conducted on farmers' fields showed that untapped yield reservoirs are large and that existing genetic potential is far greater than has been realized (see Table 2.5.4). Under real-farm situations in on-farm demonstrations, the benefit-cost ratio under rain-fed situations was as high as 8.21 for safflower and 9.27 for groundnut (see Table 2.5.5). The genetic potential of the available varieties are two to four times the current national and state average yields.

Table 2.5.2: All-India Area, Production, and Yield of Annual Oilseeds

Year	Area (in hectares)	Production (metric tons)	Yield (kg/ha)	% Coverage under irrigation
1950-51	10.73	5.16	481	-
1960-61	13.77	6.98	507	3.2
1970-71	16.64	9.63	579	7.4
1980-81	17.60	9.37	532	14.3
1985-86	19.02	10.83	570	16.0
1990-91	24.01	18.46	767	-
1991-92*	25.00	18.32	733	-
1992-93†	25.25	19.50	772	-

* Estimated; † Expected

Source: Indian Council of Agricultural Research.

Table 2.5.3: Annual Oilseeds Varieties Notified up to August 1992

Crop	Number
Groundnut	67
Rapeseed-Mustard	49
Soybean	36
Sesame	33
Linseed	25
Castor	17
Sunflower	17
Safflower	14
Niger	3
Total	**261**

Source: Indian Council of Agricultural Research.

Table 2.5.4: Yield Potential (q/ha) of Newly Evolved Oilseed Varieties

Crop/Variety	Average	Highest	National Average
Groundnut (ICGS-11)	27.0	52.7	8.2
Indian-Mustard (RH 819)	13.4	21.8	7.2
Soybean (PK 472)	25.0	30.4	7.1
Sunflower (MSFH-17)	16.4	39.8	4.5
Safflower (HUS-305)	14.6	20.6	4.5
Linseed (Gaurav)	9.6	22.2	2.7
Castor (GCH-4)	22.3	32.1	5.4

Source: Indian Council of Agricultural Research.

During the eighties, the availability of vegetable oils was higher than ever before, but demand outpaced supply, with the result that prices of edible oils rose sharply as compared with those of other commodities (see Table 2.5.6). Further, to increase oilseeds cultivation, particularly of new crops in new regions, the government year after year declared increased support prices of different oilseeds (see Table 2.5.7). After the TMO was set up and began following an integrated approach, imports of edible oils (see Table 2.5.8) decreased from 1.82 million tons (worth Rupees 10,610 million) in 1987-88 to 0.11 million tons (Rupees 790.0 million) in 1990-91, and the export of oilmeals, oilseeds, and minor oils had more than offset the value of imports (see Table 2.5.9).

The export of hand-picked and selected (HPS) groundnut, however, will not make headway until the high aflatoxin load is taken care of. Similarly, the export of rapeseed-mustardseed meal is not likely to pick up unless its glucosinolates are removed. In the solvent extraction of oil from soybean, the hexane left in soyameal, which contains 50 to 55 percent protein, would restrict diversification of its products. As a result, the farmer quite often got only the worth of the by-product rather than that of the main product. In case of linseed, the valuable dry stalk goes to waste, with the result that fibre worth Rupees 500 million is imported every year. Further, linseed pulp could effectively be used for currency-grade paper making. Nevertheless, for want of industrial backup, this sector remains unexploited, and the country continues to import high-quality paper to meet its domestic requirements.

Table 2.5.5: Economics of Improved Technologies under Real-farm Situations

Crop	Additional Investment (Rupees/ha) on Improved Technology		Incremental Benefit/Cost Ratio	
	Rain-fed	Irrigated	Rain-fed	Irrigated
Groundnut				
(Rainy season)	420-2,080	58-2,083	2.46	9.72
(Winter/Summer)	-	668-1,998	-	4.15
Sesame	225-1,048	561-1,075	4.15	2.87
Soybean	512-1,815	-	4.67	-
Castor	276-966	403-1,561	2.66	3.14
Niger	399-803	-	2.15	-
Sunflower	-	300-2,400	-	3.82
Rapeseed-Mustard	215-1,523	132-1,092	3.18	5.94
Linseed	455-1,063	606-2,200	2.77	2.61
Safflower	396-1,344	177-685	2.69	8.21

Source: Indian Council of Agricultural Research.

Among oil-bearing plantation crops, oilpalm potential is rated quite high. Suitable oilpalm materials are being identified, and potential pockets are being exploited for cultivation on a long-term, sustainable basis. The oilpalm area expanded to 2,000 ha in 1991-92, due to the establishment of three seed gardens, one nursery, and one demonstration processing plant and organization of front-line demonstrations and training programs at a total programme cost of Rupees 110 million for the year. Further, 15,000 ha of additional area was proposed for coverage during 1992-93.

Table 2.5.6: Wholesale Price Index Numbers*

Year	Edible Oil	Rice	Wheat	Pulses	All Commodities
1982-83	104.9	115.0	111.2	94.2	104.9
1984-85	126.3	121.4	110.8	130.8	120.1
1986-87	144.2	134.2	127.1	128.3	132.7
1988-89	170.2	161.2	154.2	199.7	154.2
1990-91	223.3	178.3	172.1	227.5	182.7

*Base: 1981-82 = 100.

Source: Indian Council of Agricultural Research.

Table 2.5.7: Minimum Government Support Prices (Rupees/100 kg) for Different Oilseeds

Year	Groundnut	Soybean		Sunflower	Rapeseed/ Mustard	Toria	Safflower
		Black	Yellow				
1976-77	140	-	-	150	-	-	-
1977-78	160	145	-	165	225	-	-
1980-81	206	183	198	183	-	-	-
1985-86	350	250	275	335	400	360	400
1990-91	580	350	400	600	600	570	575

Source: Indian Council of Agricultural Research.

Table 2.5.8: Edible Oil Importation from 1980-81 to 1990-91

Year	Quantity (million tons)	Value (million Rupees)
1980-81	1.07	5,160.0
1985-86	1.12	4,880.0
1986-87	1.50	6,680.0
1987-88	1.82	10,610.0
1988-89	0.37	2,460.0
1989-90	0.61	3,280.0
1990-91	0.11	790.0

Source: Indian Council of Agricultural Research.

Table 2.5.9: Export of Oilmeals, Oilseeds, and Minor Oils from 1985-86 to 1990-91

Year	Quantity (thousand tons)	Value (million Rupees)
1985-86	699.0	754.1
1986-87	1,533.4	3,131.6
1987-88	1,161.3	2,308.0
1988-89	1,761.2	4,960.0
1989-90	3,070.8	8,468.0
1990-91	2,775.0	9,636.4

Source: Indian Council of Agricultural Research.

Structural Adjustments and Policy Initiatives

In view of the slow progress in production of oilseeds in the country, the government instituted a Technology Mission on Oilseeds, a task force of all concerned government agencies, in May 1986. On the recommendation of the mission, the government has approved an integrated policy on oilseeds production, import, distribution, and pricing aimed at accelerating self-reliance.

The basic objective of the mission was set in February 1986, when the Prime Minister of India defined the scope and strategy of the mission as follows:

> *One of our biggest problems today in the agricultural sector is oilseeds. We are setting up a thrust mission for oilseeds production. When we talk of a mission, we mean an exercise starting from the engineering of the seeds and finishing with the finished products of the vegetable oil which could be delivered to the consumer. We would like to put one person in charge of such a mission, with full funding, with no restrictions on him, whether bureaucratic or otherwise. The only limits will be certain achievements which must come within a certain time frame. This will cut across a number of ministries where we find a lot of hassles and projects getting stalled because the interaction is not smooth enough.*

The mission adopted a four-pronged strategy:

- improvement of crop technology for stepping up yields and profit to farmers;
- improvement of processing and postharvest technology, since at present about 500,000 tons of oil are lost annually through inefficient processing;
- strengthening services to farmers, particularly in the areas of technology transfer and input supply; and
- improving price support to farmers and financial and other support to the processing industry.

The important areas/targets of each of the subsectors, each headed by a chairman, are as follows:

Crop Production Technology (Mini Mission I)

- increasing yield potential by 20 to 50 percent;
- reducing crop-growing duration by five to twenty-five days;
- breeding disease- and pest-resistant varieties;
- increasing oil content by 6 to 25 percent;
- exploiting tissue-culture techniques in coconut and oil palm;
- producing nucleus and breeder seeds for subsequent large-scale multiplication; and
- developing appropriate production and protection technologies.

Postharvest Technology (Mini Mission II)

- modern integrated processing technology;
- technology for minor and unconventional oil-bearing materials;
- technology for better oil recovery; and
- improvement of *ghanis* and oil expeller units.

Input and Service Support to Farmers (Mini Mission III)

- strengthening the extension system for transfer of technology to farmers;
- streamlining the production and distribution of seeds;
- streamlining the supply and distribution of fertilizers, pesticides, and implements; and
- arranging for distribution of credit.

Price Support, Storage, Processing and Marketing (Mini Mission IV)

- timely declaration of prices;
- efficient procurement operations;
- expansion and modernization of storage facilities;
- creation and expansion of integrated modern processing facilities in the cooperative sector;

- modernization of existing processing facilities in the private sector;
- modernization of the marketing system;
- fair prices to consumers; and
- introduction of packaging systems.

The mission is headed by a senior official of Special Secretary status, who reports to the Minister for Agriculture and Co-operation. Since one of the critical functions of the TMO is coordination, a policy-making and communications network has been established with the following principal elements:

Empowered Committee on Oilseeds Policy

A policy-making body consisting of the secretary to the Prime Minister, the Cabinet Secretary (who acts as chairman), and the secretaries of the principal government agencies with interest in the vegetable oil industry, from the production of oilseeds to marketing and trade. Among others, the membership of the committee includes the secretaries of finance, commerce, the planning commission, agricultural research and education, and civil supplies. It meets as the occasion demands.

Standing Committee

Set up to supervise the work of the mini missions. Among its members are the secretaries of several important departments, who also serve on the empowered committee. The chair is the secretary of the Department of Agriculture and Co-operation, and meetings usually are held quarterly.

Mini Missions

The TMO has adopted a strategy that successfully earned self-reliance for the country in food grains, cotton, jute, and dairy products, covering the four areas of crop

Identification of technological bottlenecks and concerted research efforts ensured varietal development and generation of matching agroproduction and protection technologies befitting different regions, situations, and farming systems. This brought back confidence in the merit of technologies and led to their adoption.

Quality seed of improved varieties and hybrids was rated as crucial, and much-needed thrust and incentives accorded from breeder to foundation to certified seed production of improved varieties and hybrids improved their availability and use in enhancing productivity and production. This also provided much-needed insulation to fluctuations in production. Buffer stocking of seed provided ways and means for contingency planning, and much-needed incentives provided an impetus to the seed industry to ensure availability befitting actual requirements. The momentum gained in this endeavour is likely to pay dividends for many more years to come.

Provision of credit facilities and timely supply of agricultural inputs at a reasonable cost provided a congenial environment in which to translate proven production and protection technologies.

Test-stock seed production and on-farm demonstrations brought back confidence among farmers in the farmworthiness of production and protection technologies. This created much-needed awareness about the use of the right kinds of seeds and appropriate varieties and hybrids.

Remunerative prices provided much-needed incentives for desired investment in oilseed production, processing, value addition, and supply of edible oils for public consumption.

Declaration of support prices and the presence of effective market intervention machinery right in the area of production minimized the risk of distress sale likely in a situation of higher production. The environment was so congenial that farmers resorted to cultivation of new crops in nonconventional regions and seasons without risk in the sale of their produce.

Suitable policy adjustments for procurement, handling, processing, and disposal of oilseeds of forest origin, plus incentives to the industry, provided a congenial environment for tapping nonconventional sources of oil, including rice bran, cottonseed, maize, etc., which ultimately augmented overall oil availability in the country.

Incentives provided for the development of farm implements and machinery specifically for oilseeds and rain-fed cropping systems—including their design, prototype development, fabrication, and supply—helped in undertaking smooth and timely field operations. This area is also likely to have a continuing effect for many more years to come.

Commitment of government policy makers, scientists, development officials, industry, and farmers provided a much-needed harmonious thrust to the overall development of the sector. Development of an efficient monitoring system and provision of on-course correction mechanisms facilitated the implementation of the programs and attainment of the well-conceived goal of self-reliance in vegetable oils. The policy environments created and measures undertaken in research and development should provide far more beneficial effects in years to come.

2.6

Oilseeds Genetic Resources with a Production-to-Consumption Approach

P. M. Perret and H. Kamau

International Board for Plant Genetic Resources

This presentation briefly reviews the International Board for Plant Genetic Resources'[1] past input on oilseeds dealt with by the IDRC Oilcrops Research Network and its subnetworks and outlines the crop genetic resources network programme initiated by IBPGR in 1989. The need to coordinate units within a future network based on production-to-consumption systems and, more specifically, for oilseeds genetic resources units will be emphasized. Taking sesame as an example, some lines of action will be developed in the hope that this proposal will provide the basis for further discussions among participants.

IBPGR Achievements

Descriptor lists, which provide a standardized language for the exchange of data, are essential to crop genetic-resources work. IBPGR has been responsible for publishing more than sixty such lists for various crops, all of which have been developed and/or reviewed by international experts. Among these lists, descriptors for sunflower, *Brassica* and *Rapnanus*, sesame and safflower are of direct concern here.

IBPGR also has supported numerous collecting missions, especially during its first fifteen years of existence. For example, 251 sesame accessions and 53 sunflower

[1]IBPGR is now the International Plant Genetic Resources Insitute (IPGRI).

accessions were collected through IBPGR multicrop collecting missions within the countries participating in the IDRC oilcrops subnetworks.

No specific training courses have been conducted on annual oilseeds, although for perennial oilcrops, IBPGR has organized two coconut courses. However, the genebank staff has had the opportunity to benefit from numerous training courses on general topics such as exploration, maintenance, and documentation of genetic resources.

Of more specific interest is the IBPGR/FAO support to the multiplication and characterization of the sesame collection at Hebrew University of Jerusalem, which Professor Ashri described to participants in the sesame and sunflower subnetworks meeting in Cairo, Egypt, in September 1989. This collection includes more than 1,600 accessions, with related passport and characterization data for more than 15 descriptors. It has been duplicated in the Rural Development Administration Genebank of the Republic of Korea as an international sesame base collection and, more recently, in the national genebank of Kenya and in the National Bureau for Plant Resources (NBPGR), India, both also as sesame base collections. The collection also has been sent to the Faculty of Agriculture of Kamburuptya, Sri Lanka, which is interested in evaluating this material.

Finally, IBPGR is supporting an NBPGR project for characterization, documentation, and evaluation of sesame germplasm. The project will be complemented by an Indian specialist's internship for further work in sesame.

Within the framework of the European Co-operative Programme for Crop Genetic Resources Network, coordinated by IBPGR, the achievements and proposals of the Sunflower Working Group have been presented to you (see page 132).

The *Brassica* Working Group, which was established in 1991, is more focused on vegetable *Brassica* crops. However, the Centre for Genetic Resources, The Netherlands, has accepted responsibility for collating the European database for cultivated *Brassica*, including rapeseed. The group also agreed to establish a list of a few descriptors common across Europe that are of particular value in characterizing the material and providing users with the most important information. Two scientists from France and Poland agreed to develop such a list for *Brassica* oilseeds. Among common research priorities, an ecogeographic survey of *Brassica* genetic resources in North Africa, together with an evaluation of collecting needs, was rated a high priority. Finally, the European Cooperative Program/Group *Brassica* wishes to develop and maintain close relations with other groups collaborating in work relevant to conservation and use of *Brassica*. It has asked IBPGR to assist in the establishment of these contacts.

Crop Genetic Resources Networks

In 1986, IBPGR, concerned with enhancing the use of genetic resources and linking the so-called active collections more effectively with base collections in a global effort for better conservation of the world's genetic resources, launched in 1988 a programme for the implementation of genetic-resources networks based on the concept of crop gene pools. Indeed, the crop and its gene pool is the building block that allows specialists from different fields to come together and agree on a collaborative action plan.

In addition, the networking structure provides each partner with an equal opportunity to participate in decision-making and planning, thus ensuring greater involvement of all parties.

The general objectives in establishing crop networks are to lead to more systematic and coordinated efforts for the collecting of disappearing germplasm; to increase safe duplication of the material, ensure its more efficient maintenance, and make existing data related to the material better available; to strengthen links between conservationists and users; to open new avenues for collaborative research to solve bottlenecks; and to enhance the use of the diversity existing in genebanks.

Barley, rice, beta, musa, and coconut genetic resources networks have been established so far with the assistance of IBPGR.

Establishment of Crop Genetic Resources Coordinating Units: A Proposal

Global and regional oilseed networks based on the production-to-consumption systems approach proposed within this workshop seem to be the most likely strategy through which to provide the countries concerned with the possibility of becoming fully self-sufficient for oil consumption and, when an international market exists, competing with the developed world for oil export. Considering the diversity of the problems and the amplitude of the task, the creation of functional coordinating units (subnetworks) will be required within the global regional networks. Mechanisms for interaction between each coordinating unit will have to be established in order to avoid the need to define objectives in isolation. One of the major roles of the global network's steering committee will be to follow up and supervise the activities of the coordinating units.

The links between the national genebanks and breeding/production sectors have not been taken sufficiently into consideration within the previous IDRC oilcrops network. The systematic and coordinated exploration, conservation, characterization, and use of oilseeds germplasm will be of primary importance for each crop, in which genetic improvement will be retained as one of the parameters to be taken into account for global progress. The establishment of germplasm coordinating unit(s) is therefore called for, because the area of distribution of diversity for oilseed crops, like any other crops, is never contained within national borders. The germplasm coordinating unit(s) are also a priority because proper collecting of such diversity, systematic screening for interesting characters, documentation, and necessary prebreeding efforts can not be covered efficiently by isolated national programs, each with limited expertise and scarce funds. Thus sharing of activities, following expertise and specific interests, is a prerequisite. Such collaboration, when it comes to genetic resources, needs to go on across East Africa, East Asia, and West Asia and North Africa (WANA) and involve the participation of countries that were not part of the previous oilcrops networks (i.e., the Republic of Korea in East Asia).

Because of sesame's general low yields, shattering of seeds, and indeterminate habit, plus problems common to other crops such as susceptibility to diseases, genetic improvements will help solve many production constraints. As an example for further discussion, the action that could be followed for a sesame genetic resources subnetwork is briefly described below.

Sesame

All countries from East Africa, WANA, and South Asia that have an interest in conservation and exchange of sesame data and material should be part of the Sesame Subnetwork. The countries that have identified, with the support of socioeconomic studies when necessary, that increase of sesame production is a priority within their oilseeds programs would constitute the backbone of such a unit.

Obviously, a sine qua non condition for subnetwork membership is the free exchange of sesame germplasm (outlining, if necessary, which types of breeding lines may be excluded) and of all data related to the material.

One of the primary responsibilities of the foundation workshop will be to identify an institute that will commit to acting as a central database for the subnetwork (or institutes that have regional databases that will agree to merge their data to form a central database). As a first step, selected passports and management data from all countries should be collated to compile and inventory of all existing accessions. The latter, besides being the reference document for exchange of available germplasm, is essential for the network's development. It will allow the network inter alia to identify gaps in existing collections, ensure the safe duplication of the germplasm into base collections as nominated by participants, and share the regeneration workload, taking into account ecoclimatic conditions of the accessions' origins.

Germplasm exploration, maintenance, and documentation are the basic common operations of a crop genetic resources network. Further research, evaluation, and enhancement of objectives obviously will vary for individual crop gene pools due to specific crop conditions and, above all, the requirements of participating countries. As mentioned earlier, a sesame genetic resources coordinating unit within the WANA, East Africa, and South Asia regional networks based on the production-to-consumption systems approach would have a natural vocation to develop collaborative activities for evaluation and enhancement of the germplasm.

A first target certainly could consist of identifying a minimal list of characterization/ evaluation descriptors of immediate interest to users and/or gaining a better understanding of the genetic diversity distribution in the existing collections. Since the approach is production-to-consumption, such descriptors also may include market-oriented characteristics. The selected characters should then be observed using international standards, to be agreed upon, on part or all of the germplasm held by the respective genebanks. Data already collated in different locations for the collection assembled by Dr. Ashri, and the analysis of these data, are a good starting point for this exercise.

Further to a large preliminary screening of diversity, the subnetwork will have to consider projects for in-depth evaluation, crosses, creation of populations with specific characteristics, and, eventually, even breeding of varieties. The nature of these enhancement activities will depend on scientific considerations of sesame genetic improvement needs and on conclusions of analyses conducted by the central database on all collated data. It will also be a function of feedback and recommendations from other coordinating units (marketing, socioeconomic, farming sector, etc.)

Basic activities on sesame exploration, conservation, and characterization essentially will have to rely on funds already committed by national programs, but the in-depth evaluation and prebreeding activities will require external support. Projects resulting from an extensive and effective collaboration among numerous countries and justified and supported by a steering committee that represents all sectors related to the harmonious development of an oilseeds programme will be attractive for channeling bilateral or international funds.

Conclusions

A global network—or regional networks—based on the consumption-to-production systems approach are an appealing strategy for the development of oilseeds programs within WANA, East Africa, and South Asia. More systematic exploration, exchange, and screening of genetic resources, and hence a narrower collaboration between established national genebanks and breeders, will be a prerequisite for long-term increases in oilseeds production. In due consideration of the limited funds and expertise available to each national programme as well as of the existing oilseeds genetic diversity, which cuts across all three regions, the creation of germplasm coordinating units within the global network is the most rational way to ensure genetic improvement. To ensure their long-term operational potential and a fast impact, such coordinating units should be based on the crop gene pool concept; indeed biology, breeding status, status of genetic resources conservation, and documentation differ from crop to crop, as do the specific action requirements that will come from the production and consumption sectors.

Sesame has been provided as an example in this presentation, but a similar scheme would apply to sunflower, oilseed *Brassica*s, and any other oilseed crops. Under the assumption that the concept of a global network will be endorsed by the participating countries, it is proposed that, as a first step, one of these oilseed crops be selected to form a pilot subnetwork.

IBPGR is ready to assist in linking this coordinating unit with other institutions (networks working with the same crop) and provide the necessary technical expertise and advice in its development. Despite its small budget, IBPGR will also be willing to provide limited financial support for organization of the workshop that will be necessary to launch this coordinating unit.

2.7

Achievements and Prospects of the European Co-operative Research Network on Sunflower

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The European Co-operative Research Network on sunflower was established in 1975 at the consultation meeting held in Bucharest, Romania, in October 1975. The coordination of the network was entrusted to the Research Institute for Cereals and Industrial Crops (RICIC), based in Fundulea, Romania. RICIC voluntarily fulfilled this responsibility up to 1988, when the coordination centre was moved to Novi Sad, Yugoslavia, to the Institute of Field and Vegetable Crops.

The main purposes of the Sunflower Network have been to undertake joint applied research on sunflower, according to an accepted methodology and agreed division of tasks, and to exchange experience and information among the participating institutions. In its first twelve years, the network was organized into a limited number of subnetworks corresponding to the adopted research topics, each of which was to be investigated by a liaison centre. In the later period, research cooperation has been based on working groups. The network also has published the scientific bulletin *Helia* annually since 1978.

Although initially intended to include only the European countries, the network has extended its activities to take advantage of the experiences of countries outside Europe, receive scientific information regularly, and participate in joint research programmes.

Research Achievements

A large network of trials with sunflower hybrids was organized in eight biannual cycles from 1976 to 1992 in order to identify the highest-yielding and best-adapted cultivars. Two hundred hybrids, representing the recent achievements in sunflower breeding worldwide, were tested in international trials in forty-five locations in thirty-six countries.

Cooperation in the field of sunflower applied genetics has been focused on genetic control of the main traits involved in sunflower productivity: oil and protein quality, resistance to pathogens, and pollen self-fertility. The joint study on new sources for cytoplasmic male sterility resulted in the identification of various sterility types deriving from interspecific crosses of wild species with the cultivated sunflower.

The cooperative activity related to the use of wild species in sunflower genetics and breeding has rendered remarkable results, especially concerning collection, conservation, and screening of wild species. In 1984, this activity was transferred to the European Co-operative Program-Sunflower Group (EPC/GR) under the aegis of the International Board for Plant Genetic Resources (IBPGR).[1]

A general survey of sunflower diseases in Europe was conducted and the results mapped, with positive results regarding spreading and prevention of destructive diseases such as downy mildew, white and grey rots, phomopsis, leaf spot, etc. A research topic on fungicide control of parasitic fungi by seed and plant treatment as well as an integrated pest management control recently have been added.

A list of the authorized or promising herbicides in use, as well as a list of the main weed species in each country, was compiled in the first stage. At a subsequent stage, methods of herbicide application were studied, with emphasis on herbicides less susceptible to rainfall that could be applied after sunflower emergence.

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[1]IBPGR was later transformed into the International Plant Genetic Resources Institute (IPGRI).

Studies of sunflower response to irrigation have provided preliminary information on the effects of different water regimes on plant development and production, as well as on methods of obtaining maximum water efficiency when water is scarce (i.e., maximum yield per unit of water). Scientific cooperation in this field has been directed toward better mastery of the physiological phenomena of sunflower in terms of yield formation.

Current Research Foci

The periodic analysis and review of activities within network consultations, subnetworks, and working-group meetings have permitted several research topics to be reoriented based on the principle of flexibility and gradual development, existing scientific staff and facilities, and advances in joint research activities.

At present, the European Co-operative Research Network on Sunflower is organized into seven working groups. Each gathers researchers from different countries to work jointly on certain research topics

The Working Group on Experimentation with Sunflower Hybrids studies a set of twenty hybrids in fourteen locations in the Northern Hemisphere. Similar trials are being organized in the Southern Hemisphere.

The Working Group on Genetic Study of Agronomic Traits will continue its activities to determine the heritability of traits based on parent-progeny relationships.

The Working Group on Evaluation of Wild *Helianthus* Species will concentrate on the maintenance and collection of wild species and determination of morphological and botanical characters to complete the international database on wild sunflower. Interspecific hybridization of wild species with cultivated sunflower will continue. Wild species will be evaluated for oil quality, protein content, disease and insect resistance, and tolerance of drought and salinity.

The Working Group on Identification, Study, and Utilization of New CMS Sources in Breeding Programmes will continue to search for new CMS sources, comparing them by using a genetic approach to restoration of cytoplasmic male sterility sources. CMS sources will be compared using biochemical and/or molecular approaches.

The Working Group on the Use of Biotechnology in Interspecific Hybridization will expand its activities for a more detailed characterization and description of wild *Helianthus* species, including studies on their biochemical and molecular genetics. Research will continue to optimize tissue/embryo culture techniques for rapid propagation and androgenetic haploids to obtain inbred lines. Applicable techniques for successful genetic engineering also will be developed.

The Working Group on Genetic Studies of Physiological and Biochemical Characters will concentrate its activities on oil and oil quality, protein content, and amino acid composition. The group also will continue research on drought tolerance.

The Working Group on Studies of Common Methodologies and Population Dynamics of Pathogens will establish a programme on the standardization of methods of artificial inoculations. It will also work on variability of different pathogens, studying the host-parasite interaction.

Looking at the Future

In the seventeen years of its existence, the European Co-operative Research Network on Sunflower, sponsored by the FAO Regional Office for Europe, has contributed significantly to the development of sunflower genetics, breeding, and crop technology. More than 140 scientific and extension papers resulting from joint research projects were published in *Helia* between 1978 and 1991, providing scientific and technological support for a continuous increase in sunflower production within and outside Europe.

However, the very modest financial support by FAO and the limited resources of participants pose difficulties in the execution of the adopted projects. These have resulted in partial or incomplete investigation of research topics, frequent abandonment of responsibilities, and sporadic contacts and communications between participants. The European Co-operative Research Network on Sunflower should extend its area of activity to developing countries outside Europe, selecting applied research topics of common interest and identifying the corresponding sponsors. Closer cooperation or even integration with the IDRC-supported Oilcrops Research Network should be taken into consideration.

2.8

Oilseeds Status and Potential in the WANA Region

Akhtar Beg

FRMP, ICARDA

The International Centre for Agricultural Research in Drier Areas (ICARDA) was established in 1977. It carries out research and trains personnel to help the developing countries of West Asia and North Africa (WANA) to enhance their agricultural production and thus improve living standards. ICARDA research is focused on rain-fed agriculture, which accounts for about 70 percent of the region's cultivated land. ICARDA is funded mainly by the Consultative Group for International Agricultural Research (CGIAR).

ICARDA has been designated as a world centre for research on barley, lentils, and fava bean and a regional centre for bread wheat, chickpea, pasture, and forage crops. ICARDA is organized into four research programs:

- Cereals Improvement,
- Food Legumes Improvement,
- Pasture, Forage, and Livestock Improvement, and
- Farm Resource Management (FRMP).

Supporting programmes at ICARDA include the

- Genetic Resources Unit,
- Training Unit,

- Scientific and Technical Information Unit, and

- Computing Services Unit.

Headquarters and the main research stations of ICARDA are at Tel Hayda, 30 kilometres south of Aleppo in Syria. ICARDA also has several substations in Syria and two in Lebanon. It works with individual countries by collaborating with their national research and training institutions. ICARDA serves a region that has a population of more than 400 million. The climate in the region is largely Continental. Summers are invariably hot and dry. Precipitation is received in winter, and most arable lands receive from 200 to 600 mm of rain annually. Typically, the growing season is from October-November to May-June. Thus crops are subject to all the hazards of a harsh winter: snow, frost, drought. Scorching heat and high winds are the stress factors crops face in summer throughout the region.

The countries ICARDA works with stretch from Morocco in the west to Pakistan in the east, Turkey in the north, and Sudan in the south. The statistics that will be presented here are for the twenty-four countries of the region.

Population pressures in WANA cause increasing demands for food. Per capita imports of agricultural products in WANA are greater than those of any other region in the world. ICARDA tries to improve food production in the WANA countries most hit by shortages.

In West Asia, ICARDA works from centres in Syria, reaching out to neighbouring countries: Cyprus, Iraq, Jordan, Lebanon, and Turkey. In North Africa, ICARDA originally worked in Tunisia and more recently has worked in Algeria and Morocco. It is also working in the Nile Valley of Egypt and Northern Sudan and recently added Ethiopia. Work is also in progress in the high-elevation lands of Turkey and in the western part of Pakistan.

As with many food items, there is a critical shortage of edible oils in the WANA region. Local production was only about 1.6 million tons in 1990, compared to requirements of more 6 million tons. In the WANA-region countries, major local production of edible oil comes from cottonseed as a by-product (53 percent), about 20 percent from olive, 12.5

percent from sunflower, and the remaining 14 percent from soybean, rapeseed, sesame, and groundnut, as summarized in Table 2.8.1.

Table 2.8.1: Estimated Local Production of Edible Oil from Olive and Oilseed Crops in WANA during 1990

Oilseeds	Quantity (metric tons)	Oil Content (%)	Edible Oil After RBD* (%)	Edible Oil (metric tons)
Olive	1,923,000	20	12	230,760
Cottonseed	5,136,000	20	12	616,320
Groundnut	459,000	37	29	133,110
Sunflower	1,217,000	40	32	389,440
Sesame	230,000	50	42	96,600
Rapeseed	363,000	40	32	116,160
Soybean	383,000	20	12	54,960
Total	**9,711,000**			**1,628,350**

Source: FAO Production Yearbook (1990).

*RBD = refined, bleached, deodorized

The deficit of edible oil in WANA in 1983 was 2.5 million metric tons; in 1989, it rose to 4.04 million metric tons and to 4.41 million metric tons in 1990. In the year 2000, the deficit will be 5.7 million metric tons. Future deficit figures have been worked out by ICARDA economists (see Table 2.8.2).

Evidently, the gap between local production and consumption of edible oils in the region is large. As a result, almost all the countries have to resort to importation of edible oils in large quantities, a forex expense that some of these countries can ill afford.

Table 2.8.2: Edible Oil Deficit in WANA

Year	Metric Tons (millions)
1983	2.50
1989	4.04
1990	4.41
2000	5.70

Sources: FAO Trade Yearbook (1983, 1989, 1990); "The Food Gap" in *Sustainable Agriculture for the Drylands: ICARDA Strategy* (1989).

In 1989, WANA countries spent about US$ 1,300 million and, in 1990, US$ 1,500 million on importation of 2.52 million metric tons and 2.6 million metric tons of edible oils from different crops. Similarly, WANA countries also imported edible oils originating from different trees in quantities of around 1.5 million metric tons in 1989 and 1.8 million metric tons in 1990. Table 2.8.3 gives figures for 1990 only.

Of the total oil imported in 1990 from annual oilcrops as well as trees, approximately 37.74 percent was palm, 29.38 percent soybean, 18.5 percent sunflower, 5.57 percent rapeseed and mustard, 3.11 percent maize, 2.48 percent cottonseed, and a small quantity groundnut. Around 1 percent each of olive, palm kernel, and coconut oils also were imported. In addition, 0.35 million metric tons of animal fat was imported for various uses at a cost of US$ 138 million.

Past imports of edible oils in the region show that escalation in edible oil imports has been around 9 percent per annum, of which 4 percent can be attributed to increases in consumption per capita and the rest to population increase.

The major importer of edible oil in the region was Pakistan (22.55 percent), followed by Egypt (17.01 percent), Turkey (13 percent), and Iran (12.17 percent). These four countries were responsible for almost 65 percent of the total WANA oil imports. Further, more than 23 percent was imported by five other countries: Iraq (5.3 percent), Algeria (8.37 percent), Morocco (3.6 percent), Tunisia (3 percent), and Saudi Arabia (2.67

percent). The remaining fifteen countries imported about 15 percent of the total imports of 4.41 million metric tons in 1990 (see Table 2.8.4).

Table 2.8.3: Summary of Edible Oil Imports in WANA during 1990

Edible oil	Rate/ton (US$)	Quantity (metric tons)	Cost (US$ 1,000)	Quantity (% of total)
Palm	388.97	1,667,655	648,681	37.74
Soybean	527.72	1,298,277	685,155	29.38
Sunflower	551.70	817,708	483,286	18.50
Rape/Mustard	552.82	246,113	136,057	5.57
Maize	854.91	137,407	117,471	3.11
Cottonseed	549.64	96,472	53,025	2.18
Palm kernel	646.92	72,565	33,737	1.64
Coconut	551.80	43,345	23,918	0.98
Olive	2,044.90	31,016	63,525	0.70
Linseed	1,010.93	7,409	7,490	0.17
Groundnut	1,325.58	344	456	0.03
Total	509.88*	4,418,311	2,252,801	100.00
Animal Fat/ Oil	391.53	352,458	138,001	
Total Fat Consumed		4,770,769	2,390,802	

Note: Rate per ton is weighted average.

Source: *FAO Trade Yearbook* (1990).

There is some import of whole oilseeds (16 million metric tons) as well, in various countries, at a cost of US$ 125 million (see Table 2.8.5).

Table 2.8.4: Imports of Edible Oil to WANA during 1990

Country	% of Total
Pakistan	22.55
Egypt	17.01
Turkey	13.01
Iran	12.17
Iraq, Algeria, Morocco, Tunisia, Saudi Arabia	23.00
Other 15 countries	15.00

Source: FAO Trade Yearbook (1990).

Table 2.8.5: Importation of Oilseeds into WANA during 1990

Oilseeds	Quantity (metric tons)	Cost (US$ 1,000)
Cottonseed	35,007	10,832
Groundnut	13,216	15,696
Sunflower	7,174	6,099
Sesame	100,841	91,029
Rapeseed	230	181
Soybean	3,133	1,001
Total	**159,574**	**124,838**

Source: FAO Trade Yearbook (1990).

Due to this state of affairs in the WANA region, ICARDA recently initiated research-and-development activities on oilseed crops. The main crops considered suitable for the WANA region—on which ICARDA activities are concentrated—are rapeseed (mostly double-low varieties) and safflower (for winter-rainfall areas). Sesame and sunflower (OPV) are considered suitable for the spring season for sowing on stored moisture with provision of supplementary irrigation in low-rainfall areas.

ICARDA's work will focus mainly on collection, evaluation, and increase of varieties of these four crops for subsequent distribution to client countries for testing. Similarly, ICARDA will standardize production practices for different situations and environments.

Research has been initiated from the last growing season at Aleppo, and the brief results presented here show the potential of the four crops. The only economic way to increase oilseed production in rain-fed areas is to utilize fallow areas whenever possible to maximize land-use efficiency.

Rapeseed

The rapeseed varietal trial (see Table 2.8.6) was planted in three replications in plots 9.5 x 2.1 m. Row-to-row distance was 15 cm, and the seed rate was 5 kg/ha. The crop emerged on 3 November after the first rainfall. Average yields of good *Brassica napus* and a *B. juncea* line is approaching 1.5 tons, which, under rain-fed conditions, is a good yield. This preliminary test, mainly to increase seed, will be laid out in high- and low-rainfall areas, with several sowing dates, next season. The varieties (from Canada, Europe, and Australia) included in the test were

1. Tobin
2. Ac Parkland
3. Regent
4. Westar
5. ASC N1
6. ASC N3
7. Cutlass
8. Shiralee
9. Eureka
10. Taparoo
11. Titan
12. Jumbuck
13. Maluka
14. Wesreo
15. Wesroona
16. Wesway
17. Pivot
18. Ceres
19. Cobra
20. Rex

The yield range given in Table 2.8.6 is highly encouraging, showing good potential in the region for all three species: *B. napus, B. campestris,* and *B. juncea.*

Table 2.8.6: Rapeseed Performance under Rain-fed Conditions in Tel Hayda, ICARDA, 1991-92

Variety	Yield Range (kg/ha)
B. campestris (5)	778 - 1,129
B. napus (spring type) (12)	917 - 1,483
B. napus (winter type) (2)	709 - 758
B. juncea (1)	1,216 - 1,925
Westar (*B. napus*)	1,273 - 1,859
Jumbuck (*B. campestris*)	1,055 - 1,453
Average (2)	1,084

Notes: Sowing date 15/10/1992; harvest 26/5 to 31/5/1992; 349 mm total rainfall during the season.

Safflower

Three safflower varieties are under test, all from Turkey; var. 5.541 is spiny, early, short in stature, and high yielding in all three dates. Harvest of safflower was done by a small combine. All other data in addition to yield was also collected. The test also shows that early sowing gives higher yields, and that spring sowing yields also are encouraging (see Table 2.8.7).

A world collection of 1,701 specimens has been acquired from the United States Department of Agriculture for screening, selection, increase, and distribution. Varieties are also requested from all over the world for evaluation in WANA.

Sunflower

The trial on sunflower included open-pollinated varieties and was conducted at two locations. An average of about 1 ton at one location, Tel Hayda, is a promising yield under purely rain-fed conditions when rain was about 300 mm. One supplementary irrigation at flowering may increase the yield to 1.5 tons, and two irrigations may increase yield to 2 tons. A trial on supplementary irrigation is in progress at Tel Hayda to determine these predictions.

At the high-rainfall location, two varieties yielded about 1 ton/ha. Other varieties yielded 1.5 tons/ha. These results are promising. Elaborate trials are planned for the next few seasons at several locations. Yield results are given in Table 2.8.8.

Table 2.8.7: Safflower Performance under Rain-fed Conditions at Tel Hayda, ICARDA, 1991-92

Dates Sown	Varieties		
	5.541-2	Dinger	Yenice
24 November, 1991	2,104.63	1,790.18	959.25
26 January, 1991	1,743.70	1,359.25	687.03
23 March, 1992	950.00	911.11	538
Date of Harvest	15/7/92	30/7/92	30/7/92

Notes: Yields are in kg/ha; rainfall was 352.5 mm.

Table 2.8.8: Sunflower Performance at Two Locations in Syria in Spring 1992

Varieties	Yield in kg/ha	
	Tel Hayda	Jindiress
Edirne*	1,251	1,605
Viinimk*	1,248	2,599
Non Oil†	1,148	1,906
H.O.I.†	802	-
TR - 129*	716	993
TR 259*	627	525
Reevods§	538	996

Key: * is from Turkey; † from Syria; and § from Pakistan.

2.9
Perspectives Following Review of the Indo-Swedish Collaborative Research Programme on Cruciferous Oilseeds, 1979-1990

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In most developing countries, demand for edible oils and protein has been increasing for a long time. In many, current consumption levels of crucial nutrients such as oils, fats, and protein are far below minimum nutritional requirements. In India, per capita daily consumption of edible oil in the 1980s was only 14 g—considerably lower than the nutritional standard of 31 g. In spite of having one of the largest cultivated areas under oilseeds in the world, India has a shortage of edible oil for cooking.

Important sources of vegetable oils, both in India and in Sweden, are the cruciferous oilseed crops including rapeseed (*Brassica napus, B. campestris*), mustard (*B. juncea*), and eruca (*Eruca sativa*). The protein-rich presscake from these seeds is used for stock-feeding purposes in Sweden and mostly as manure in India. However, the occurrence of erucic acid in cruciferous oil and glucosinolates in the presscake restricts the use of these products for food and feed.

Programme Structure

The Indo-Swedish Collaborative Research Programme on Cruciferous Oilseeds between institutions in India and Sweden started in 1979. The programme was directed to achieve close collaboration between scientists in the two countries, with the objective of improving plant breeding and cultivation techniques for *Brassica* crops and maximizing seed production for use as human food and animal feed. The interdisciplinary approach agreed upon emphasizes the flow of rapeseed/mustard material through the entire production-to-consumption chain. The programme included funds for upgrading equipment essential for running specific projects by Indian scientists. In addition, annual exchanges for Indian scientists to train in Sweden and for Swedish scientists to visit Indian institutions were valuable components of the joint research collaboration. The original 1979 document placed emphasis on the importance of long-term perspectives in the cooperative investigations. It also stressed the programme's potential as a resource in future cooperation between India and other countries in the Asian region.

The collaborative research programme was funded by the Swedish and Indian governments. On the basis of the evaluations undertaken and the developmental relevance of the collaborative programme, the different joint research projects were prolonged for three-year periods, up to 1990.

The working model of the joint research programme takes the interdisciplinary flow of *Brassica* seed material through the entire production-to-consumption chain, with research activities organized in four sectors: plant breeding, cultivation techniques, process and product development, and nutrition and toxicology. Interactions and effects on the material with integrated investigations in all four sectors were to be evaluated. For example, breeding results had to be evaluated under cultivation technique, considering environmental effects on yield-building factors as inputs to seed processing and effects on oil and cake for further evaluation of nutritional and toxicological aspects. Results obtained from investigations of processing and nutrition then possibly could be transferred back to breeding and cultivation techniques for further penetration.

The model for interdisciplinary research was easier to adapt to Swedish conditions than to Indian ones, due to the fact that Indian scientists so far had no tradition of this new approach to integrated investigations. The great number of scientists and universities involved in the programme in India also influenced the adaptability of the research model, as illustrated by Figure 2.9.1.

ORIGINAL SEED

Yield and Quality of Seed
Oil
Protein
Glucosinolates
Drought Resistance
Resistance to *Alternaria*
Aphid Resistance

SEED PRODUCTION

Plant-stand Establishment and Growth
Sowing Time
Sowing Rate
Row Spacing
Nitrogen Fertilization
Frost Tolerance
Aphid Population Dynamics
Aphid Host-plant Characters
Crop-production Models

SEED

Seed Analysis
Seed Multiplication

PROCESSING TECHNIQUE

Ghani
Expeller
Pungent Oil

OIL

Conventional and Special Analyses
Harmonization of Methods
Oil Products and Toxicity
Oil Pungency

PRESSCAKE

Mineral Availability
Sensory Properties of Food
Antinutritional Substances
Protein Quality

Figure 2.9.1: Stages and Considerations in the Indo-Swedish Collaborative Programme

The interdisciplinary approach was extremely hard to apply at the start of the research programme. The new approach needed time to be fully realized by all persons involved. The situation improved during the second year. Personal contacts, exchanges of letters, and discussions between scientists enhanced communication, favouring the application of the programme idea.

Scientist Exchange

During the planning and initial stages of the Indo-Swedish research programme, it became clear that the active researchers in both countries needed training and education in their counterpart country (i.e., Indian scientists should visit Sweden, and Swedish scientists should visit India) if cooperation were to be satisfactory and the projects were to be effective. In addition, participation in joint programme seminars and international rapeseed conferences were considered to be of high importance. A special fund was therefore set up to cover travel costs and per diem expenses for the Indian scientists participating in seminars and visiting Sweden.

A total of sixty-four exchange scientists from India representing fifteen different universities and research institutions have visited Sweden for training under the programme. (Most of the scientists had Ph.D. degrees from universities in India.) Such training was strictly limited to projects covered by the Indo-Swedish Collaborative Research Programme. Altogether, seventeen scientists from the participating institutions in Sweden have visited India, the majority only once. Eight of these scientists had Ph.D. degrees and the others M.Sc. degrees.

Joint Seminars and Workshops

Seminars, workshops, and symposia are considered extremely stimulating components in a research-collaboration programme. Reporting and continued planning of research projects are important components of progress. It is also important that as many scientists as possible participate on such occasions. At seminars in India, the participation of Indian scientists from different levels has been common and highly desirable. On account of limited travel resources, it has not been possible to include many Indian scientists in the seminars held in Sweden.

Most of the scientists who participated in the programme seminars were actively working on *Brassica* research. A great number of the Indian participants also were administrators and senior scientists. In addition to these participants, officials such as ambassadors, the state secretary, state officials, the head of the Planning Commission, director-generals, ministry officials, etc., also participated.

Swedish Prime Minister T. Fälldin officially visited India when the Indo-Swedish Joint Workshop was held in New Delhi in 1982. The Prime Minister stated in his opening address that "the workshop on oilseed was an example of how development cooperation can, step by step, benefit the interests of both countries. Our patterns of production and consumption are different, [but] India and Sweden share a common interest in developing production in an area of great importance to all of us."

At the concluding seminar in 1992, the joint programme was reviewed, and scientists exhanged research findings. In addition to the opening session of this seminar, the Swedish ambassador in New Delhi handed over to Indian government representatives seed material of thirty-five lines with improved quality.

Table 2.9.1 lists the workshops, seminars, and symposia organized under the joint programme.

Some Scientific Achievements

Scientific achievements of short- and long-term investigations within the four research sectors have improved the status and productivity of *Brassica* crops and their utilization in the two countries. A number of the findings constitute a new technology that is applicable and supportive of overall production. The following are illustrative:

- produced lines with zero erucic acid, low glucosinolates, yellow seeds, and increased protein content;

Table 2.9.1: Indo-Swedish Collaborative Research Programme on Cruciferous Oilseeds Workshops, Seminars, and Symposia

Name of Workshop/ Seminar/ Symposium	Date and Place
Indo-Swedish Joint Workshop on Rapeseed and Mustard	9-11 February 1982 New Delhi, India
Interlaboratory Harmonization of Analytical Methods	14-15 February 1984 Hyderabad, India
Joint Review Meeting of the Indo-Swedish Collaborative Research Programme on Rapeseed Mustard Improvement and Oil and Protein Utilization	28 February 3 - March 1983 New Delhi, India
Joint Working Scientists Workshop	4 September 1985 Skokloster, Sweden
Research on Rapeseed and Mustard	4-6 September 1989 Uppsala, Sweden
Concluding Seminar on Indo-Swedish Collaborative Research Programme on Rapeseed/Mustard Improvement and Utilization, 1979-1990	March 20-21 1992 New Delhi

- identified Indian and Swedish genotypes with a very wide adaptation range and yield stability;
- identified and developed drought-tolerant lines and cultivars;
- found different disease attacks by *Alternaria* in Swedish and Indian cultivars and lines;
- increased seed yield and improved seed quality by modified cultivation technique;

- evaluated frost damage on mustard and developed frost-simulating techniques for release of new frost-tolerant cultivars;
- developed crop-production models;
- evaluated population dynamics of mustard aphid;
- studied odour communication and host plant characters of aphids;
- identified ways of interdisciplinary harmonization of analytical methods;
- identified improved processing technique;
- established by means of sensory evaluations that the pungency of oils could be demonstrated only before cooking;
- identified properties of the quality of high mineral availability in *Brassica juncea;* and
- evaluated quality of oil and presscake in relation to *ghani* processing.

Conclusions

Since the Indo-Swedish Collaborative Research Programme started in 1979, agricultural statistics have showed yield increases of rapeseed and mustard in India from approximately 500 kg to some 900 kg per ha and a corresponding seed production increment from 1.8 to 4.4 million tons. This is a highly substantial production development that may have its source in ideas and inputs from the programme. The growth and stability of India's food economy is considered very much linked with the growth and stability of the oilseeds sector.

2.10
Coconut Research-and-Development Activities in Tanzania

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A. Mpunami, G. Chipungahelo, and A. Kullaya
National Coconut Development Programme

Coconut research-and-development activities in Tanzania are within the mandate of the National Coconut Development Programme (NCDP). This programme was started by the government in 1979 to rehabilitate the declining coconut industry, with assistance from the Federal Republic of Germany and a loan from the International Development Agency (IDA).

In the beginning, research areas were

- introduction, testing, and production of (mainly) DxT hybrids;
- crop management in terms of plant nutrition, weeding, spacing, etc.;
- study of lethal disease symptoms and its causal agent and vector;
- control of the rhinoceros beetle, *Oryctes monoceros.*

The direction of research has now become more location-specific and geared toward small-scale intercropping agriculture. The main areas of emphasis are now

- improvement of the local East African Tall Coconut (EAT);
- intercropping experiments and on-farm trials;

- disease resistance trials;
- biological control of the coreid bug (*Pseudotheraptus wayi*).

The current research-and-development activities being undertaken to revive the coconut industry, achievements so far, and recommendations for future activities are outlined briefly here.

Background

The coconut palm is the most important perennial oilcrop in Tanzania. It is mainly grown along the coastal belt of the Tanzanian mainland and on the islands of Zanzibar, Pemba, and Mafia. The crop occupies an estimated 240,000 ha, with a palm population of about 22.4 million plants growing at varying densities (Agrar und Hydrotechnik GmbH 1980).

The crop is an important source of income and vegetable oil in both rural and urban areas, contributing about 40 to 50 percent of the national vegetable oil demand (Klingel 1985). About 80 percent of annual production, estimated at 540 million nuts (the equivalent of about 50,000 tons of oil) is used for subsistence (Klingel 1985).

The productivity level of coconuts is low; annual yields are reckoned at twenty-two to twenty-three nuts per palm (Balingasa 1988). This low level of productivity can be attributed to a number of biotic and abiotic factors, the most important of which are

- Suboptimal climatic conditions, characterized by a severe water deficit for five to six months per year, mainly due to poor rainfall distribution.
- Poor crop husbandry practices. Production is in the hands of small-scale farmers who are either reluctant to apply improved crop husbandry practices or unable to afford farming inputs such as fertilizers, chemicals, etc. With the exception of intercropping practices, weeding is not a common practice; thus palms are subjected to an undesirable competition with weeds for nutrients and moisture.

- Presence of economically important pests. The rhinoceros beetle (*Oryctes monoceros* olive) causes damage to both bearing and nonbearing palms, while the coreid bug (*Pseudotheraptus wayi* brown) is considered the most serious coconut pest in the country.

- Presence of serious diseases such as lethal disease (LD) of the coconut palm, caused by mycoplasmalike organisms (MLO).

- Lack of adapted, high-yielding varieties and quality planting materials.

- Presence of overage groves that are declining in production.

Coconut Research and Development Activities

The National Coconut Development Programme (NCDP) was initiated in 1979-80 by the Ministry of Agriculture and Livestock Development (MALD). The objective was to revive the coconut industry through research-and-development activities. Emphasis is on the following activities:

- identifying the major coconut pests and diseases in Tanzania, assessing their economic importance, and conducting research studies on appropriate pest- and disease-control strategies;

- testing of different crop husbandry practices in on-station and on-farm trials with the objective of developing an appropriate agronomic package sustainable under smallholders' conditions;

- breeding for improved coconut planting materials that are adapted to prevailing conditions of disease and drought;

- training and advising coconut growers and nursery operators on improved crop-husbandry and nursery-management practices.

Agronomic Research

The objective of NCDP agronomy research is to determine agronomic requirements for coconuts under different agroclimatic conditions in Tanzania and to provide relevant recommendations to coconut growers. Emphasis has been on three major research components:

- Plant nutrition. Exploratory and long-term fertilizer trials at several sites revealed that different nutrients are limiting in the various soils.

- Soil moisture conservation and crop management. Trials designed to study the reaction of different coconut varieties to different crop husbandry practices have revealed that, in most cases, intercropping is more important than fertilizer application, and complete weeding is more effective than ring weeding.

- Variety trials to assess performance under different agroclimatic and management conditions. Initial results from these trials indicated that dwarf x tall (DxT) coconut hybrids were superior to the local East African Tall coconut population in terms of growth, precocity, and initial yield. However, subsequent performance of the introduced hybrids under prevailing conditions of lethal disease and severe drought stress has been rather disappointing.

Breeding Research

The ultimate goal of the coconut breeding research programme in Tanzania is to breed lethal-disease-resistant coconut varieties that are tolerant of drought and minimum-input cultivation but able to respond to improved cultural techniques.

Initially, emphasis was on the establishment of seed farms for dwarf x tall (DxT) hybrid seednut production. Two hybrids, Mawa and Camwa, were released to farmers in 1987 with the expectation that they would resist lethal disease and tolerate drought. (Mawa is a cross between Malayan Yellow Dwarf (MYD) and West African Tall (WAT), while Camwa is a cross of Cameroon Red Dwarf with WAT.) Production of these two hybrids now has stopped, due to their rather disappointing performance with respect to tolerance/resistance to drought and lethal disease. Emphasis is now being put on improvement of the local East African Tall (EAT) through selection and cross-breeding.

After at least two years of observation and yield recording, individual palms are selected on the basis of annual nut and copra production per palm and on the basis of fruit component characteristics. In other words, only those palms with above-average copra yield and desirable fruit characteristics (high fruit weight, low husk content, but high copra content) are selected.

In the cross-breeding programme, priority is given to palms that have so far survived lethal disease. To date, two sib-progenies of two tall coconut populations and eight DxT crosses have been produced for field testing.

There is also keen interest in establishing an embryo culture laboratory to facilitate safe movement of coconut germplasm within the country and from other countries in keeping with the International Board for Plant Genetic Resources' technical guidelines for such activities and to facilitate storage (conservation) and regeneration of cryopreserved embryos.

Pest-control Research

The general objective of pest-control research is to identify the major coconut pests in Tanzania and develop a viable integrated pest management strategy with emphasis on biological control.

Initially, research efforts gave highest priority to the biological control of the *Oryctes monoceros* Olive by using a virus — *Baculovirus oryctes* Huger — and a fungus — *Metarrhizium anisopliae* (metch.) Sor. Encouraging results were obtained in the laboratory, and these led to the field release of the virus and the fungus. Unfortunately, results obtained from the field were less promising and difficult to quantify. In the case of *Metarrhizium,* the relatively dry conditions in the coconut-growing areas of Tanzania probably were not favourable for growth/development of the fungus.

Since 1985, pest-control research has emphasized the coreid bug, *Pseudotheraptus wayi* Brown. This is a serious coconut pest in Tanzania that feeds on female coconut flowers and young nutlets, causing premature nutfall. In severe cases, yield losses can be up to 100 percent.

Although results show that some chemicals, particularly pyrethroids, can be used to control *P. wayi* effectively, satisfactory results are difficult to achieve, especially during the rainy season. Moreover, chemical spraying of tall palms is difficult (if not impractical), and it is unlikely that smallholders could adopt this method or afford its necessary technology.

In view of these considerations, more emphasis is being put on biological control of *P. wayi* using the African weaver ant, *Oecophylla longinoda* Latreille. In-depth studies have been conducted on

- population dynamics and damage surveys of *P. wayi,*
- the biology and ecology of both *P. wayi* and *O. longinoda,* and
- different strategies to enhance the establishment of *O. longinoda* in the field, including field introduction of *Oecophylla* nests and swarming queens; interplanting of coconuts with citrus and other *Oecophylla* host plants; and the use of an ant bait, Amdro, to control the competitor ant, Pheidole megacephala.

Most of these research activities have now been concluded, and the results can be summarized as follows: The *P. wayi* population has been observed to fluctuate considerably during the year. Introduction of *Oecophylla* nests in the field is only effective for a relatively short period. However, better results are obtained if the introduction is done during the swarming period. Intercropping coconuts with citrus encourages establishment of the weaver ant. Finally, application of 3 g Amdro per palm and per *Oecophylla* host tree is sufficient to control *Pheidole* for a considerable length of time, resulting in an increase in the *Oecophylla* population.

Disease-control Research

The main aim of this programme is to research methods of effective control of lethal disease (LD) of the coconut palm and of other minor diseases in Tanzania. The following research activities have been initiated and concluded:

- studies and descriptions of the symptoms of lethal disease.
- etiological studies confirming the association of mycoplasmalike organisms (MLO) with LD,
- vector identification and disease transmission trials (less encouraging),
- epidemiological studies revealing that LD is less severe in the northern districts (Tanga, Pangani) and in Kenya, compared to Bagamoyo, Kisarawe, Kilwa, and Rufiji districts, and
- screening for resistance to lethal disease among introduced and local germplasm.

Since 1981, eleven dwarfs, fourteen talls, and fifteen dwarf x tall coconut hybrids have been imported and planted together with different subpopulations of the local East African Tall (EAT) in six disease-resistance trials. At the beginning, priority was given to testing imported genetic material, some of which had shown resistance to lethal yellowing disease in Jamaica, a disease with etiology similar to that of lethal disease.

Data obtained from these trials suggest that none of the imported genetic materials have an acceptable level of resistance. Among the locally collected germplasm, the EAT subpopulation from the Livestock Breeding Station (LBS) in Tanga appears to show good prospects for disease resistance.

One major constraint associated with these field trials is the impossibility of infecting the palms artificially. Therefore, some surviving palms that are assumed to be resistant may have escaped infection. However, recent developments in molecular biology suggest that there are good prospects for developing reliable diagnostic and screening techniques for coconut MLO based on DNA probes. The project will be actively involved in developing and testing these biotechnologies in the framework of an African research network on detection and control of lethal yellowing-type diseases, to be financed by the European Community.

Farming Systems Research (FSR)

The objective of farming systems research is to develop and test technologies that are appropriate for the coconut farmer by conducting adaptive research in on-farm trials with active cooperation and participation by the farmer.

Emphasis in FSR has been on conducting reconnaissance surveys in different areas, so as to get background information on the major farming systems and the relative importance of coconut production in these areas. Testing of the performance of the local EAT and two recommended hybrids, Mawa and Camwa, in on-farm intercropping trials also has taken place. Farmers' preferences are taken into account in deciding the types of crops to be interplanted.

Coconut Development Activities

The Coconut Extension Service section is responsible for the provision of training and advisory services on improved crop husbandry practices to coconut growers through demonstration plots, farmers' field days, extension handouts, etc. The section is also responsible for distribution of seednuts to private and public nurseries, as well as training and advising nursery operators.

Since hybrid seednut production has been stopped, farmers are now being provided with selected local EAT seednuts from Tanga and Pangani districts, where lethal disease incidence is low. Concurrently, NCDP is establishing a 55-ha EAT seed farm at Chamezi using subpopulations from Tanga region (LBS, Vuo, Boma, Madanga, Boza, and Mwambani).

One of the most recent developments initiated by NCDP is the promotion of postharvest technologies, particularly traditional small-scale oil processing technology and coconut wood utilization.

Future Requirements and Priorities

The ongoing research-and-development activities for coconut should be continued. These include

- screening and breeding for resistance to lethal disease and drought tolerance, with emphasis on local germplasm;
- developing sustainable biological-control measures against *P. wayi*. Research also should be initiated to identify and study other coconut pests such as the *Aceria* mite;
- conducting adaptive research in on-farm trials to test different crop husbandry practices, including pest-control measures, under farmers' conditions; and
- strengthening training and advisory services to coconut farmers on improved crop-management practices.

Conclusions

For many years, improvement of perennial oilcrops in Tanzania has been neglected. Since the establishment of the National Coconut Development Programme (NCDP), however, different research and development aspects of the coconut have been looked into. Research facilities and funding have been adequate, and during this period, collaboration with other international research institutions was established and enhanced. Due to the nature of the crop, most of these activities are long-term endeavours that will require long-term commitment of personnel and financial and technical support.

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2.11

The Status of the Sesame Germplasm Collection

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Sesame is an "orphan" crop; 99.9 percent of its area is in developing countries, but it is not covered by any of the international institutes. Realizing this, the Food and Agriculture Organization (FAO), International Board for Plant Genetic Resources (IBPGR), and International Atomic Energy Association (IAEA) have sponsored efforts to enhance research and improvement.

In 1987, IBPGR[1] gave Hebrew University a two-year grant to assemble as large a collection of the world's sesame germplasm as possible. In 1988, approximately 1,600 accessions were grown, evaluated for ten traits, and their seeds multiplied. The bulk of the lines was obtained from the USDA. Several hundred lines were sent by South Korea, and smaller numbers were obtained from other countries.

IBPGR designated the genebank of the Rural Development Administration (RDA) in Suwon, South Korea, as a base collection, and, accordingly, seeds of the collections were sent there. Later, IBPGR designated the genebank of the Kenya Agricultural Research Institute, near Nairobi, as a second base collection, and another set of seeds was sent there in the spring of 1992.

In 1991, the university obtained funding from other sources. Several hundred newly received accessions were then grown and multiplied. As of summer 1992, approximately one thousand additional accessions had been grown and will be multiplied. Seeds of the 1991 and 1992 nurseries were obtained mainly from the USDA and from members of

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[1]IBPGR is now the International Plant Genetic Resources Institute (IPGRI).

the network and its coordinator. After harvest, the seeds will be shipped to the two base collections, to be maintained in perpetuity.

There are three major gaps in the collection: China landraces, India landraces, and wild species. The landraces of China and India are poorly represented in the world collection, and efforts should be made to rectify this. Thirty or more wild species of *Sesamum* are known, all but one endemic to Africa. Most are found in the western part of the continent, but some are found in eastern and southern Africa. These wild species should be collected and studied, perhaps by IBPGR regional offices working with various national research organizations.

Section 3

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Special Reports

3.1
Minutes of the Oilcrops Research Network Steering Committee Meeting, Kenya, 14-18 January 1991

Abbas Omran
Network Consultant

As the network project was in a one-year phase (February 1991-January 1992), IDRC thought that a thorough evaluation of the impact of its ten years of activities on the improvement of oilseeds research and the welfare of the small farmer in the network regions should be made. The main participants in the meeting were the steering committee members, guest speakers from Kenya, and an evaluation expert.

Guest speakers outlined several topics. The gap between supply and demand in Kenya was of concern. The IDRC-supported vegetable oil/protein systems project based at Egerton University in Njoro was trying to analyze the situation in order to bridge this gap. Another IDRC-supported project with the University of Nairobi was trying to improve sesame production. The generation of a vegetable oil/protein strategy for countries with low dietary fat intake was outlined. The need for the development of an information system was reported. The concept of a crop genetic resources network was discussed by IBPGR/IPGRI.[1]

The participants also were briefed on the African regional agricultural research systems presented at the Southern Africa Center for Cooperation in Agricultural Research (SACCAR)/Special Program for African Agricultural Research (SPAAR) meeting. A proposal for a crop- management training project for Kenya and Eastern Africa was

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[1]The International Board for Plant Genetic Resources is now the International Plant Genetic Resources Institute.

presented by the Centro Internacional para el Mejoramiento de Maiz y Trigo (CIMMYT). The chairmen of the four subnetworks talked briefly about the activities of their sector.

The production-to-consumption systems research (PCSR) approach and the capacity-building project were introduced to identify leaders and develop mechanisms through which to incorporate and expand PCSR.

Most of the time was spent learning and discussing how the evaluation process should start. Dr. Neil Thomas, the evaluation expert, led the discussion toward the establishment of an evaluation strategy during the remaining year of the project. The committee decided that the network itself should be evaluated, in addition to separate evaluations of oilseeds projects in China, Nepal, Ethiopia, Sudan, and India. Logical framework analyses (LFAs) were drawn up in a tutorial way for the Steering Committee members to learn and execute.

Discussions and recommendations were spread throughout the time of the meeting. Here are but a few:

- Allowing the low prices in Kenya were due to importation and not to imports as such. If imports are allowed, imports rule the market; if disallowed, the cost of production is high.

- Collaborative research of various types is more important as a group of research problems divided into sets. Location-specific problems have to be taken individually.

- A series of questions was raised:

  What do the countries do within themselves?
  What do the countries do with donor assistance?
  What do the countries do at the regional level?
  What do the countries do at the collaborative level?
  How do we get collaboration more clearly defined?

The response to these points raised more questions and requests:

- Problems should be classified as either regional or interregional.
- The committee members of the subnetworks seem to require more opportunities for interaction.
- The gaps and priorities that need to be addressed should be identified.
- Work should be allocated to different countries on the basis of priorities.
- The forum should be used to gather resources from other regional organizations for the network.
- If the resources were available, what would be the ideal structure of a network, in the opinion of these subnetworks, which can be recommended to other donor agencies?
- Ad hoc interactions were observed throughout the network. This needs to be addressed.
- In a network, it is important to be very clear about goals and objectives right from the start.
- The objective of the network can now be "to improve the national economies of network members by way of improved small farm incomes."
- The coordinating unit needs to be expanded. The location could remain in Ethiopia or be moved elsewhere.

Evaluation Session

- Clear and sharply focused problems are fundamental in research.
- Looking to see to what extent the objectives have been met are critical verifiable indicators.

- Productivity, stability, sustainability, and equity are good verification indicators.

- Training and other components also should be gauged.

- Evaluation of projects should necessarily involve specific definitions, evaluation of the use of resources in research methodology for efficiency, impact evaluation depending on the length of time spent on the project, and documentation of the evaluation process (this would be a part of research methodology). Special projects (e.g., breeding programmes that have a long gestation period) may be hard to evaluate, but a good plan of work is critical in evaluating even a breeding programme. The milestones of the project are critical to this.

- Monitoring and evaluation should be country-specific.

- A network meeting might be held during the off-season in September in Pakistan. A Steering Committee meeting would follow.

- Subnetworks can meet within a certain period two days prior to the network meeting, to reduce travel expenses.

- There is already an in-built momentum within the network that may be lost.

- The subnetworks should continue as they are until the guidelines from the evaluation are complete. The network needs to have a clear workplan.

- Research in any project can not be said to be complete until some adoption is accomplished.

- Pilot adoption can be the case, but the impact should not be a part of the objective.

Discussions then concentrated on methods of evaluation: Who will evaluate which project and when? Where are reports to be sent? When will the next evaluation meeting be held? November 1991 or January-February 1992 appeared to be the best time, so that the evaluators would have enough time to prepare their final reports.

3.2

ORN Evaluation: Summary Report

Neil Thomas
Thomas Development Associates

IDRC has sponsored an Oilcrops Research Network since 1981. The network has gone through three phases. Phase III, initiated in 1987, is the focus of this evaluation. Achievements of earlier phases included assignment of an adviser, establishment of an oilseeds library, visits of the adviser to regional projects, germplasm collection, several workshops, publication of a newsletter, collaboration between Canadian and regional projects, and consultancy visits.

The objective of Phase III was to strengthen the oilseeds research carried out in South Asia and East Africa by establishing effective, practical liaisons between national oilseeds programmes. Specific objectives that defined the nature of this liaison included technical support, germplasm exchange mechanisms, information exchange, technical training, and the development of new network forms.

The form of the evaluation was established at the Network Steering Committee meeting held in Kenya in January 1991. Two main components were subsequently defined: questionnaires to be sent to a sample of network members and an on-site review of the Adviser's Unit in Addis Ababa, Ethiopia. Both of these activities were undertaken in 1991. Some IDRC-funded oilcrops projects were evaluated separately.

Phase III Achievements

In general terms, the majority of the objectives specified for Phase III has been met. Specific achievements by objective include

National Programme Support

The adviser has contributed significantly to national programmes in terms of time dedicated to arranging workshops and training courses and publishing a newsletter. The number of programmes in the network has precluded annual visits to each one, so that technical support from the adviser at the programme level does not appear to have been significant. Evaluation results suggest that the strong emphasis that the network should have had on strengthening African programmes more than Asian ones has not obviously been achieved. The adviser dedicated more travel time to Asia and North Africa than to East and Southern Africa. Some of this orientation can be explained by the use of Asian resources in training activities.

Germplasm Exchange

The network has contributed significantly to the exchange of germplasm between member countries, especially as bilateral mechanisms have been ineffective. Germplasm of all major crops covered by the network has been multiplied in Ethiopia and redistributed to network members. The network has multiplied and distributed 419 accessions since its inception.

Information

The adviser has compiled and published an annual newsletter with a distribution of approximately six hundred recipients worldwide. The newsletter contains both papers and abstracts, and members see it as a significant source of information on oilcrops. Six workshops have been conducted since the beginning of Phase III, three specifically on *Brassica*s; one on sesame, sunflower, and other oilcrops; and two others on oilcrops in general. Several technical bulletins and reviews of different oilcrops topics have been published.

Training

During Phase III, four training courses have been conducted. A fifth was due to be conducted at the time of the evaluation but was delayed by difficulties in clearance for participants. Trainees were extremely positive about the content and benefit of the courses, and the majority have applied what they learned to their research programmes. Most trainees were plant breeders; others included agronomists, pathologists, and entomologists.

New Network Forms

A steering committee and network subcommittees were formed. Originally intended to be involved significantly in network management, funding constraints reduced the extent to which this was possible. Network members believed that formation of these committees did improve members' management of the network.

The intention to fund collaborative projects was not realized. While some planning was achieved, most projects foundered on bureaucratic constraints to their implementation. While network members viewed such projects as important, apparently they were not of such high priority as to merit significant attention.

Subnetworks achieved different degrees of development and autonomy; the *Brassica* Subnetwork became the strongest. Most training and workshop resources have been dedicated to the *Brassica*s. Network members wish the present crop orientation to continue, although they suggest amalgamating the other subnetworks.

Linkages with other agencies in information dissemination and network funding have not been very successful due to the different emphases of these bodies. Some of the material published in the newsletter is now being forwarded to more crop-specific newsletters published by other bodies.

Questionnaire Response

Network members did not respond to the questionnaires in the numbers hoped for. The final universe of respondents was not sufficiently large to allow conclusions to be drawn on some topics. Lack of response may be an indicator of members' perceptions of the importance of the network. General conclusions that may be drawn include

- The network has served principally the breeders of National Oilseeds Research Programs (NORPs). Potential impact on the outputs of such NORPs is therefore principally restricted to the development of new varieties. Few NORPs were cognizant of the development effects of their new varieties. Only 25 percent of respondents indicated that network inputs had contributed to released varieties, although some indicated that new varieties were still in the pipeline.

- Respondents generally believe that the network was not given the resources necessary for it to become self-sustaining during Phase. III.

- Germplasm exchange remains a priority within the network, and the current crop orientation is the format the members wish to retain.

- Members rated workshops above the newsletter in terms of information exchange.

- Improved research quality was seen as the main benefit the NORPs derived from the network.

- The Coordinating Unit in Ethiopia was considered to have been essential to management of the network. Its location in Ethiopia was considered to have restricted its effectiveness.

It is not possible to determine the impact of the network on each NORP or the downstream benefits to oilcrops producers. The difficulty respondents had in defining the linkage between a stronger NORP and benefits at the farm level suggests that the network could contribute to this area in the future. Other factors also influence the effectiveness of a NORP in its mandated area, and in at least one programme supported directly by IDRC, exogenous forces may have been more important in the dissemination of material to producers than the institutional channels of either the NORP or the network.

While specific impacts are difficult to determine, it is the conclusion of this evaluation that, from the scope of activities supported by the network, the time the network has been operating, and the known capacity of some of the NORPs, there has been some benefit to oilcrops producers from the network. As monitoring of the use of network inputs during Phase III was not consistent, this benefit is unquantified, and probably is unquantifiable.

Recommendations

- A shift in the network's focus from breeding to production-to-consumption systems research (PCSR). A NORP, by definition, should be more than a breeding programme.

- Continued use of Asian resources in African programme development needs to be more strategically defined, to avoid the constraints encountered in Phase III.

- A return to the original African focus will require a conscious shift of resources away from Asia, and probably a significant reduction in Asian representation on the Steering Committee.

- Advisory input should focus much more on the identified needs of member programmes. National programmes within a broader PCSR framework probably will benefit more from problem-specific consultancies and individual training attachments than the delivery of generalized services that was the pattern during Phase III.

- A future network should be subject to active monitoring, to ensure that the use of network inputs in delivering NORP outputs can be determined.

- IDRC should consider direct support to the Steering Committee chairman (e.g., a 50 percent intern scientist position) to catalyze his or her commitment.

- A network expecting ultimate benefit for a rural clientele should support its members in defining and using methods for determining this benefit.

3.3
Summary Report on PCSR and the Oilcrops Research Network (Special Study)

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Kenneth Riley

IDRC-Nepal

Foreword

The full report follows the author's series of visits to selected countries in East Africa, South Asia, and China and to West and North Africa from September 1991 to March 1992. During these visits, discussions were held with members of the Oilcrops Research Network, others involved in the oilseeds subsector, and international organizations in order to gain a better understanding of the oilseeds subsector in each country. Respondents' views were sought on how the Oilcrops Research Network might be restructured to more effectively improve the oilseeds subsectors in their countries. This report also draws on the author's previous involvement with the Oilcrops Research Network. The ideas and approaches being developed by the Vegetable Oil and Protein System programme at Egerton University and by the programme officers at IDRC's Nairobi office in Kenya, have been particularly useful.

Although the report was prepared at the request of IDRC, it was intended for those involved with the Oilcrops Research Network, other international organizations, and prospective donors. The report does not attempt to present a final proposal for the restructured network. Rather, it attempts to present the importance of continuing support for this subsector and ways the network can be structured to most effectively achieve development impact.

The full report[1] is prepared in five chapters. Chapter 1 contains the nutritional justification for increasing oil and fat consumption among population groups with low dietary intake. Chapter 2 looks at the rapid global changes that have affected production, trade, and prices of vegetable oils, oilseeds and oilmeal, while Chapter 3 compares the major features of the oilseeds subsectors in a number of countries visited. Chapter 4 briefly reviews the Oilcrops Research Network and IDRC support for oilcrops improvement and presents the findings from respondents about how the network might be restructured. Finally, Chapter 5 sets out a tentative proposal for a restructured Oilcrops Research Network to serve as a basis for discussion.

The positive response from the staffs of national programmes, industry, governments, and farmers during visits to the countries provided the motivation to prepare this report. All those who provided their time and their wisdom during discussions are gratefully acknowledged.

In preparing this report, particularly Chapter 3, I have used informal information that may or may not be strictly correct. I take full responsibility if errors have occurred in presenting this information.

Summary of the Report

Fats and oils are necessary components of human nutrition. Consumption of fats and oils is closely correlated with income. Much of the European and North American population consumes excess fats and oils, while countries in Eastern and Central Africa and South Asia are among those with the lowest per capita intakes and lowest incomes. Within these low-intake countries, there is evidence that a large portion of their populations are deficient in fat and oil intake.

Globally, both production and consumption of vegetable oils have grown twice as fast as the population. Production increases have been mostly among a few well-endowed temperate countries, with rapid expansion of palm oil production largely confined to

[1]Riley, K. W. 1992. "A Production to Consumption Systems Approach for the Oilseeds Network." Photocopy. Nairobi: International Development Research Centre (IDRC). Copies are available from IDRC.

Malaysia and Indonesia. Production of tropical annual oilseeds has declined in relative importance. As a result, imports of vegetable oil have increased very quickly in many developing countries, and such imports are a major drain on scarce foreign exchange.

An appraisal of the oilseeds subsectors of a number of countries in East Africa, South Asia, West Asia, and North Africa as well as China highlighted a number of differences and similarities and some serious concerns.

Although increased imports of inexpensive vegetable oil should be benefiting consumers and increasing intakes, these positive effects are often lost, as imported oil was found to benefit only the more affluent urban consumers and failed to reach those who most need it.

Most of these countries possess excellent potential for increasing annual oilcrops production. However, yields in most countries are low, and past research to improve oilseeds production in these regions has been much weaker than research on other crop commodities.

The development of specialized high-value oilseeds for export has been largely neglected, as has the development of high-quality oilmeal as improved livestock feed.

The greatest impact from efforts to improve the oilseeds subsectors can be expected in East Africa, where policies are rapidly liberalizing, and the value of small-scale oil production and expelling in rural areas has been clearly shown in Ethiopia and Tanzania.

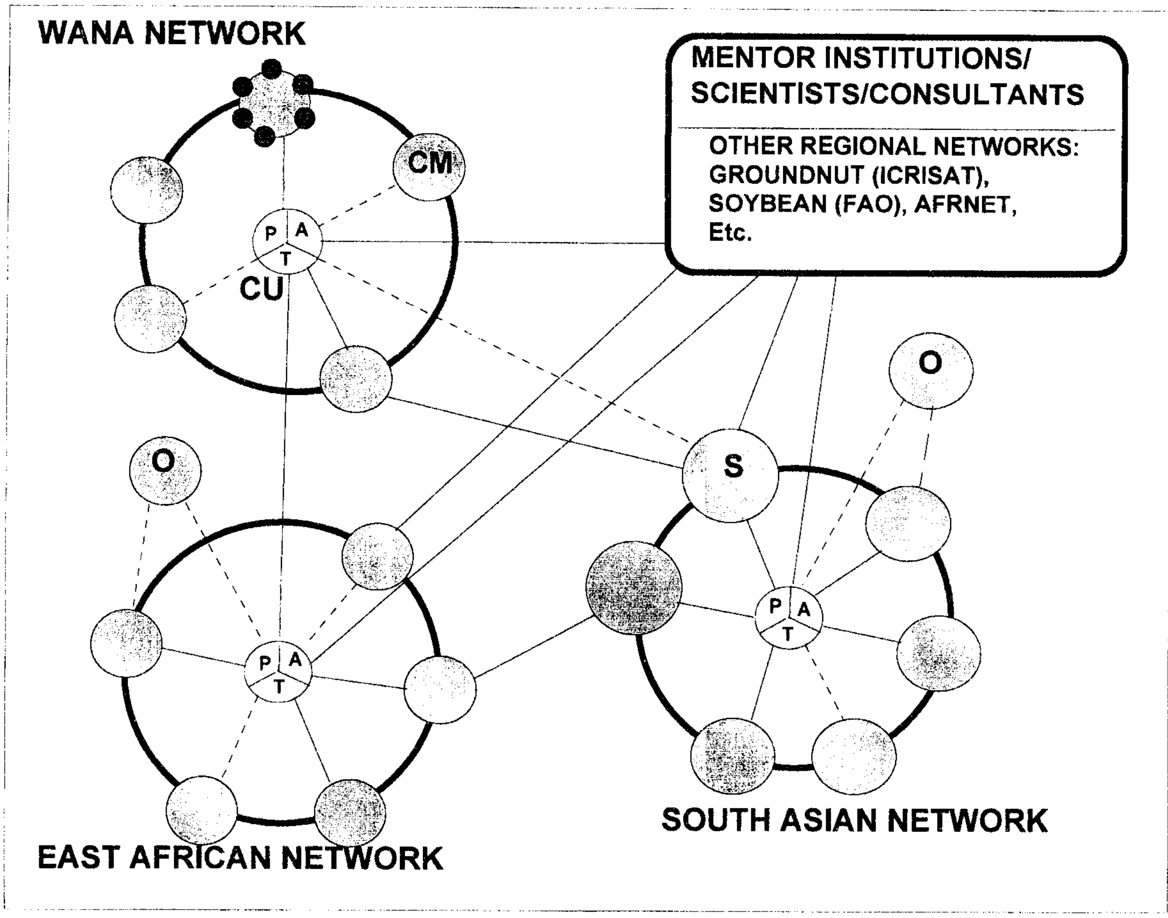
China and India have developed strong policies to increase oilseeds production and limit imports. While oilseed yields in China are generally high and consumer oil prices moderate, India's oilseed yields, although increasing steadily, are still low. As a result, India's domestic vegetable oil prices are variable and have recently risen faster than any other food commodity. The oilseeds subsectors among India's neighbours have been profoundly affected by these recent changes.

The rapidly increasing imports of vegetable oil in many West Asian and North African (WANA) countries is creating serious trade imbalances and has stimulated interest in increasing domestic oilseeds production. Such efforts must ensure that fragile land and water resources are sustained.

IDRC for the last fifteen years has devoted a considerable part of its funding to oilseeds improvement in Asia and Africa. Although this work has had an impact, genetic and agronomic improvements were found to be insufficient, unless a positive environment for increased production is created. Recent experience with a production-to-consumption systems (PCS) approach to improving the vegetable oil and protein systems in Kenya appears to hold promise of greater development impact.

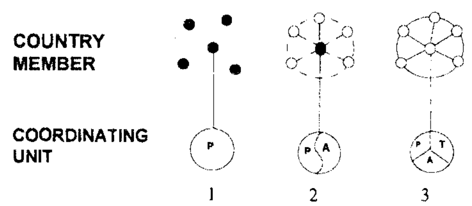
Consultations with those involved with the oilseeds subsectors in twelve countries in East Africa, South and West Asia (including China), and North Africa revealed strong endorsement of the production-to-consumption systems approach in most countries, and many practical suggestions for improving the operation and effectiveness of the Oilcrops Research Network.

A tentative proposal has been prepared for a restructured Oilcrops Research Network, based on the PCS approach, with three regional networks in East Africa, South Asia, China, West Asia, and North Africa (see Figure 3.3.1).



Legend: CM = Country Member
O = Outside Network Associate
CU = Coordinating Unit
P = PCSR Approach Support
T = Technical Support
A = Administrative Support
S = Strong Programme

Source: Riley, K.W. 1992. "A Production to Consumption Approach for the Oilseeds Network". Report to IDRC. Nairobi. Photocopy.



Possible stages in developing a production-to-consumption perspective in the oilseeds subsector with country members of the network (see notes below).

Figure 3.3.1: A Proposed Model for a Restructured Oilcrops Research Network

Notes: 1: Interest is expressed in the PCS approach. A possible lead institution/individual is identified. Support for developing the PCS is provided by the coordinating unit through discussions and studies. 2: More structured studies carried out involving the institutions relevant to the different components. Training and further support from the coordinating unit leads to an analysis of the subsector and constraints are identified. 3: Specific research and interventions are designed and implemented to overcome the specific constraints identified. Technical input and advice from the coordinating unit to support these acttivities.

3.4
Changes at IDRC and its Position

William Edwardson
IDRC-Ottawa

Before 1992, IDRC's principal activity was direct support to researchers and institutions in developing countries for research on a wide variety of topics targeted to resolve problems affecting the poorest populations in these countries.

This was carried out through a number of divisions:

Agriculture, Food and Nutrition Sciences (AFNS)
Information Sciences
Health Sciences
Social Sciences
Earth and Engineering Sciences
Communications
Fellowships and Awards
Human Resources.

Each division had a number of programmes with programme staff who identified, developed, and monitored projects according to set criteria defined by each. These programmes essentially were organized by discipline.

AFNS is probably the most familiar of these original divisions. Its six programmes included Crop Production Systems, Animal Production Systems, Fisheries, Forestry, Post Production Systems, and Agricultural Economics. AFNS had a staff of approximately twenty-seven and an annual budget of approximately CAD 25 million.

Most AFNS staff members were based in regional offices, with a representative of each programme in most offices.

Due to continued budget limitations and a decision to implement a new, broader interdisciplinary strategy, IDRC now has six divisions:

Environment and Natural Resources (ENR)
Information Sciences and Systems
Health Sciences
Social Sciences
Cooperative Affairs and Initiatives
Administration

ENR is the product of a merger between AFNS, Earth and Engineering Sciences, and the Environmental Policy programme of the Social Sciences Division. Of the division's thirty positions, only nine are related to the new programme of Sustainable Production Systems (in which agricultural research can be funded); four are based in regional offices and another five in Ottawa. One of these positions is primarily concerned with crops. The new division's budget is on the order of CAD 4 million.

This means there has been a major shift at IDRC, in terms of both budget and staffing, from support for purely agricultural production research. It is assumed that this area will be covered by strengthened national programmes and other donors who have continued their support for this area.

The mission of the new Environment and Natural Resources Division, within which research in the agricultural sector is still feasible, is as follows:

> *The Environment and Natural Resources Division is dedicated to supporting research to enable people, especially those that are resource poor, in developing regions of the world to meet their needs and objectives for sustainable and equitable development.*

Within this broad mandate, the division will focus on management, conservation of, and access to natural resources, particularly land and water; food security, increasing opportunities for employment through local "value-added" enterprises based on natural resources and waste management, and environmentally sound technology to avoid further degradation of the natural resources base.

The division will be looking for innovations in research and new combinations of nontraditional partners in mounting interdisciplinary systems research that includes policy and private-sector stakeholders and bridges the elusive micro-macro implementation gap.

Implications of Change for the Oilcrops Research Network

With significantly reduced resources—of both funds and staff—for agricultural research and a strategy that demands a shift toward support for innovative research processes and new partnerships to achieve more rapid results and knowledge that will have an impact on people, IDRC is unable to continue supporting the Oilcrops Research Network.

Resources for purely breeding agronomic research essentially have been cut. IDRC can only support such research in collaboration with other donors and in cases where this component has been identified as a priority for improving systems so as to increase the benefits to employment, income, health, etc.

Hence, IDRC is now turning to support of innovative processes aimed at gaining understanding of systems, such as oilseeds production-to-consumption systems research (PCSR) in all its forms, identifying necessary interventions, and following up with research and action and monitoring of their impact. IDRC's limited funds imply that support for PCSR development and applications will be the centre's only avenue of support for oilseeds systems development.

Since VOPS in Kenya has broken ground in developing PCSR approaches, and initial attempts to replicate these approaches in other parts of the region have begun, IDRC's oilseeds PCSR will target the East African region only. This will be a disappointment to many other Oilcrops Research Network members, but this difficult decision has been necessary. The network, of course, wishes to continue a broader effort and can attract support from other donors. IDRC can at least ensure that the East African activities continue as a link in the network.

This is one of many difficult decisions IDRC has had to make after many years of building relationships with dedicated researchers throughout the developing and developed world. It is important to understand that this decision is not based on any negative evaluation of the Oilcrops Research Network, its members, or its activities.

IDRC encourages each of you to see this development as an opportunity to demonstrate that the centre's support over the years has contributed to the development of a useful association of oilseeds researchers—an association that can now decide its own future and secure sufficient resources, from within member institutions and externally, to carry on.

Section 4

Analysis and Recommendations

4.1

Proceedings of the Meeting of the Steering Committee of the Oilcrops Research Network Held at Nairobi, Kenya, 13 August 1992

Abbas Omran
Network Consultant

On behalf of the member countries, the Steering Committee expressed appreciation for IDRC's great contribution to the improvement of oilcrops in the region through its uninterrupted support. The assistance rendered has helped individual countries tremendously. It has helped collectively, as well, in developing critical scientific mass and production and protection technologies for enhancing the production and productivity of oilseeds in general and of mandate crops in particular. The committee hopes that far more technology will make a strong impact on the productivity front if translated to the production system in years to come. Valuable materials in the pipeline and the scientific capabilities developed will continue to bear fruit in the near future. While acknowledging the support, the Steering Committee felt that the sudden withdrawal of support would adversely affect the programmes. The committee thus thought the need for alternative arrangements was imperative, so that the tempo built up could be maintained at least at the same pace.

In principle, the Steering Committee endorsed the formulation of three regional networks put forth by Dr. Ken Riley through his report and critical analysis. The committee felt that the modalities and different elements would need to be worked out once potential donors are ready to support the three networks.

The Steering Committee felt that to provide continuity to the overall networking, it is absolutely essential that the committee continue meeting during the changeover/

transition period for at least one year. On this account, expenditure, if any, could be borne by IDRC.

During the transition period, three core working groups involving Steering Committee members representing different regions could work out project proposals to pass to potential donors through IDRC. Dr. Zhang Yan, Dr. Badr El-Ahmer, and Dr. Joseph Wanjama of KARI-Njoro could work as convenors/liaison officers for South Asia, WANA, and East Africa respectively. Apart from the Steering Committee members, one or two experts from the respective regions could be involved in developing the proposals.

For fulfilling the aforementioned task during the interim period of one year, savings of the IDRC-supported Oilcrops Research Network and terminated/ongoing oilseeds projects could be utilized. If required, need-based augmentation of resources through additional IDRC funding could be made available.

During the interim period, IDRC may consider placing an officer-in-charge on the subject to provide logistical support to smooth the switchover to the new system.

Meanwhile, the member countries of each region will explore the possibility of bilateral cooperation, so that the fruits of research could be better utilized. They will tap the resources of local representatives of other donors in their regions, along with those of their own programmes.

Terms of Reference for Chairman of the Regional Network

The steering committee drew up/approved the following terms of reference:

1. IDRC should send the summary of the proceedings of this meeting to each member country of the three Regional Oilcrops Networks (RONs). Send it to both the chairman of the RON and the responsible high-position person in each country. Send also CA$ 500 to each chairman to facilitate correspondence about the further onward movement of the network in regard to project-proposal preparations. Inform the chairmen of the name of the contact person in IDRC,

along with the summary proceedings of the meeting. (One week—by 21 August, 1992)

2. The chairmen of each region will send out letters to the member countries of the RON requesting them to prepare the project proposals. This call should include information on the PCS approach, a summary of Dr. Ashri's presentation, and a pro forma for the project proposals. (Two weeks—by 7 September 1992)

3. Formulate the project proposals by each country, keeping the PCS approach in view, and send them to the chairman within three months. (By end of November 1992)

4. IDRC is requested to confirm the availability of funds with which to hold the meetings in each region in the first week of January 1993, within two months. (By end of October 1992)

Budget

South Asia Oilcrop Network	US$ 12,000
WANA	US$ 10,000
East Africa	US$ 10,000

5. Consider and compile these project proposals by inviting experts within each country to help him. These experts can be economists, processors, policy makers. (One month—December 1992)

6. Meet with representatives of member countries who submitted proposals. The projects compiled by the chairman will be discussed in this meeting. The projects will be further refined in these meetings. (First week of January1993)

South Asia Oilcrops Network meets in Dacca,
East Africa Oilcrops Network meets in Nairobi, and
WANA Oilcrops Network meets in Syria at ICARDA.

7. IDRC to channel to other donors the final project proposals prepared by the chairmen of the RONs. (Two months—up to the end of February 1993)

Pro Forma for Proposal on Potential Projects under the Regional Network on Oilcrops

1. Present status of oilseed crops from PCS perspective.

2. Identify constraints under existing PCS structure.

3. Identify priority areas that need immediate development attention.

4. Propose titles for the projects needed to address the priority areas.

5. Project No.
   - (a) Title of the project
   - (b) Name of executing agency/institute
   - (c) Name of the principal investigator
   - (d) Duration of the project (in months)
   - (e) Total cost of the project
   - (f) Objectives of the project
   - (g) Year-by-year plan of work
   - (h) Expected achievements at completion of the project
   - (i) Details of cost breakdown:
     - i) Cost contribution of donor agency (foreign exchange)
     - ii) Cost contribution of executing agency (local currency)
     - iii) Use of infrastructure of NORPs
   - (j) Initial approval of the respective governments.

4.2
Workshop Highlights and Issues Review

Amram Ashri
Hebrew University of Jerusalem, Faculty of Agriculture

The demand for oilcrops has increased steadily for the last fifty years, partly due to population increase and partly due to improved standards of living. Among the oilcrops, several experienced meteoric increases in production, namely soybean, canola rapeseed, sunflower, and oil palm. In every one of these cases, the breakthroughs were due to breeding achievements coupled with improved cultural practices. In the case of canola rapeseed, the breeding effort was consumer driven and focused on the need to reduce or eliminate erucic acid and glucosinolates. In the other three, the motive was the continuing quest for better yields, wider adaptation, improved qualities, and resistance to disease. At times, newly available crop supplies stimulated new uses (e.g., meat substitutes), and pressing needs led to the outstanding development of an oilcrop (e.g., sunflower in the U.S.S.R., which Romania, France, Yugoslavia, the United States, India, and South American countries later developed into a competitive hybrid industry). These four, with other traditional oilcrops, also gave new options to Africa and Asia, the regions covered by the Oilcrops Research Network.

When IDRC discovered that support for oilcrops research was very necessary in East Africa and South Asia, their countries' populations were (and continue to be) undersupplied with oil/fats, consumption being very low to low. IDRC's approach followed the general philosophy of strengthening national programs, relying to a large extent on the national oilcrops research programs (NORPs) to formulate network objectives. In view of the examples cited above, it is clear why breeding improved cultivars was a major component. The network evolved gradually at first and more rapidly in recent years, becoming overextended in a time of budget cuts.

Network activities have been evaluated in detail and in depth. IDRC can derive satisfaction from the conclusion that the network's achievements indeed justified its investment. In addition to clear benefits in terms of improved technologies, new varieties, and advancement of training leading to faster development, other indirect benefits accrued. These are hard to quantify, but such are Pakistan's adoption of the PCSR approach following its principal network scientist's exposure to the concept at a network meeting in India; the creation of genetically variable populations as source materials for future varieties; and, finally, the increased general awareness in the research, extension, and farming communities.

The Oilcrops Research Network considered oilcrops primarily from the edible-oils aspect. However, at this stage, they also deserve consideration for their nonfood uses. The market for vegetable oils tailored to meet the needs of the chemicals industry is growing. Sunflower with more than 80 percent oleic acid in the oil is highly desired by the chemicals industry. Similarly, the demand for high-erucic-acid rapeseed oil for lubricants and plastics is growing. If they can be competitive in price, vegetable oils also could replace petroleum as a raw material, and even as fuel. This would fit in well with the search for new crops currently under way in both developing and developed countries. To these uses of oilcrops should be added other considerations such as the growing demand for the protein-rich meal byproducts, which are becoming more important than oil, and the contribution increased domestic supply of meal can make to development of the livestock and poultry industries in developing countries.

IDRC has stated that, in view of changing conditions and its new mandate, it no longer can continue to support the network as it has so far. At the same juncture, new research approaches stressing interdisciplinary cooperation, systems analysis, and more comprehensive overviews are gaining importance. Since the ultimate benefits of oilcrops research in this framework should be to smaller farmers on the one hand and to improved nutrition on the other, the conclusion is that the production-to- consumption systems research (PCSR) approach is most appropriate. Agricultural conditions, research levels, population, nutrition, etc., in the network's target countries vary. Oilcrops often are grown in variable, risky environments, hence there are real constraints to production. Such constraints also are related to farmers' choices of fields for growing oilcrops versus cash crops. These decisions have to do with government price policies, traditions, etc.

In order to bring the research, extension, social, market, and nutritional considerations into play, the production-to-consumption systems approach must be adopted. Its value was demonstrated by case studies presented to the workshop. A recommendation on the next phase of the network along these lines was developed and presented in detail. The proposal envisions three regional projects, with some interaction between them. The regions proposed are East Africa, South Asia and China, and West Asia and North Africa (WANA). At this time, how the regional programs would be initiated, organized, and funded is still unclear. Workshop participants also noted that the needs are greater in Africa, especially in East Africa and some countries of southern Africa.

The needs are clear and a preferred future approach has been generally agreed. It should

- Stress the PCSR approach,
- Encourage closer horizontal cooperation between NORPs,
- Stress attention to the ultimate beneficiaries—small farmers and low-income groups,
- Add a strong outreach component through extension and informal means, such as NGOs and community groups,
- Encourage more initiative from the interested countries, and
- Define projects more clearly, and monitor and evaluate them periodically.

The workshop participants also generally agreed that future project proposals should be built in modules along regional lines or on the basis of relevant topics (e.g., closing major gaps in germplasm collection or promoting village-level oil extension). Project proposals of this nature are of course more difficult to prepare; they require more cooperation from participants with expertise in various relevant areas.

Concern about the transition period was great. Some participants suggested that the NORPs in some countries could initiate proposals and approach potential donors. Another possibility raised was that the Steering Committee, augmented by participants from Africa, could serve as a Continuing Committee, stimulating cooperative proposals by working groups, etc. Such a committee also would serve as an address for IDRC and other potential donors in the interim period. Modest internal and external funds will be needed for this effort, as seed money. Some specific recommendations have been presented by the Steering Committee.

Appendices

Appendix I
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Appendix II
Workshop Programme

Oilcrops Research Network Steering Committee Meeting and Workshop sponsored by International Development Research Centre (IDRC)

11-14 August 1992
Safari Park Hotel, Nairobi, Kenya

Monday, 10 August

Arrival and Registration	18:00-20:00	

Tuesday, 11 August

MORNING

Registration continues	8:00-9:00	
Session 1. Introduction	**Chair: Regional Director**	
Introduction	9:00-9:25	Regional Director
Programme	9:25-9:35	O. Schmidt
Logistics	9:35-9:45	L. Navarro
Coffee	9:45-10:15	
Session 2. Subnetwork Reports	**Chair: Dr. Abbas Omran**	
Introduction	10:15-10:30	A. Omran
Sesame	10:30-11:30	S. Thangavelu
Brassica	11:30-12:30	B. Singh
Lunch	12:30-14:00	

AFTERNOON

Session 2. Subnetwork Reports (continued)		
Sunflower	14:00-15:00	M. Rai
Coffee	15:00-15:30	
Other Oilcrops	15:30-16:30	B. El-Ahmar

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EVENING

Reception	19:00-21:30	Regional Director

Wednesday, 12 August

MORNING

Session 3. Other Interventions in the Subsector Chair: Dr. Masood Rana

VOPS Kenya	8:30- 9:05	B. Theora
AGREF (VOPS Regional)	9:05- 9:40	S. Chema
VOPS Nepal	9:40-10:15	A. Mishra
Coffee	10:15-10:45	
India, Policy Adjustment	10:45-11:20	M. Rai
IBPGR	11:20-11:55	A. Kiambi
Sunflower, European N.	11:55-12:30	A. Vranceanu
Lunch	12:30-14:00	

AFTERNOON

Session 4. Other Interventions (continued)

ICARDA	14:00-14:35	A. Beg
Indo-Swedish collaboration	14:35-15:10	I. Ohlsson
FAO Kenya	15:10-15:55	Kibuthu
Coffee	15:30-16:00	
National Coconut Development Programme, Tanzania	16:00-16:35	G. Chupungahelo
Others (Winrock International, Hebrew University of Jerusalem, ICRISAT, etc.)	16:15-17:00	Various representatives

EVENING

Steering Committee meeting	SC Chairperson	

Thursday, 13 August

MORNING

Session 5. Evaluation and Special Study Reports Chair: Dr. I. Ohlsson

OR Network evaluation	8:30-10:30	N. Thomas
Coffee	10:30-11:00	
ON and OR special study	11:00-13:00	K. Riley
Lunch	13:00-14:30	

AFTERNOON

Session 6. IDRC and Other Donors' Statements Chair: Zhang Yan

IDRC position	14:30-14:50	Dr. W. Edwardson
Other donors	14:50-15:30	Various representatives
Coffee	15:30-16:00	
Other donors (continued)	16:00-17:00	Various representatives

EVENING

Steering Committee meeting	SC Chairperson

Friday, 14 August

MORNING

Session 7. Highlights Review Chair: Mr. M. E. Ahmed

Highlight/issues review	8:30-10:15	A. Ashri
Coffee	10:15-10:45	
SC report	10:45-12:00	SC Chairperson
Agenda for final discussion	12:00-12:30	N. Thomas
Lunch	12:30-14:00	

AFTERNOON

Session 8. Final Discussion and Closure	**Chairman/moderator: Dr. N. Thomas**	
Final discussion	14:00-15:15	
Coffee	15:15-15:45	
Final discussion (continued)	15:45-17:00	
Closure	17:00-17:15	IDRC

Appendix III
IDRC Response to the Steering Committee Proposal

21 August 1992

TO: The Steering Committee, Oilcrops Research Network (ORN)

RE: IDRC Response to the Steering Committee Proposal for Action and Support During the ORN Transition Period

The Steering Committee (SC) provided the recent Oilcrops Research Network workshop in Nairobi (11-14 August 1992) and IDRC with three documents: "Pro Forma for the Proposal on Potential Projects under the Regional Network on Oilcrops"; "Proceedings of the Meeting of the Steering Committee of the Oilcrops Network, 13 August, 1992"; and "Terms of Reference for the Chairman of the Regional Network." These very useful documents constitute the position of the Steering Committee and a proposal for action by the committee and IDRC during the ORN transition period. What follows is the IDRC reply to this proposal, as agreed during the workshop.

Basis for the IDRC Reply

As Dr. William Edwardson pointed out in his remarks to the Steering Committee, IDRC has been forced to shrink in size. Its reorganization has reduced future funding available for activities in relation to agricultural research. The immediate problem to be addressed, then, is that no new funds can be appropriated by IDRC for future activities of the Oilcrops Research Network in its present or future form, except for very focused activity in relation to the PCSR approach in Eastern and Southern Africa. It must be remembered that Dr. Ken Riley's study was commissioned before the changes in IDRC were decided. Any financial support to the SC during the transition period will be possible only from existing savings in the current network project.

Less staff time is now available in IDRC. Thus programme officers will not be able to receive and evaluate proposals from the network, nor actively recommend such proposals to other donors. Consequently, again, the Steering Committee needs to look for other mechanisms to help with the transition and continuation of the network and depend on self-reliance and drive from those members who are motivated to define a new future for their colleagues.

IDRC Analysis of the Proposal

The Steering Committee has focused on a strategy to prepare as many country PCSR proposals as possible, for earliest submission to donors for funding. IDRC feels that this goal can not be achieved within three months. A good deal of sensitization within each country would have to occur first, or any proposal will run the risk of being perceived as rushed or imposed. A slower process was therefore proposed by the programme officers.

IDRC suggests, also, that the following are critical priorities for a transition period:

- to enable the present membership to continue to communicate with each other, and especially to exchange technical information; to maintain momentum in any ongoing, funded collaborative research; and to make results available to interested observers;

- to enable the regional convenors (the Steering Committee called them "regional chairs") to lead a process of consultation to determine what the membership of the RONs would like future networking to address and accomplish; the convenors would summarize their consultations and prepare status reports, which members are aiming to have completed within three months. This would be an interim step toward achieving a fundable proposal.

What IDRC *Can* and *Shall* Do

IDRC will make CAD 500 available to each of the regional convenors for telex/fax networking in their region. The centre will be alert to the results from the first phase of the Steering Committee action plan and stay ready to support well-justified followup meetings as anticipated and possible with available savings from the ongoing Oilcrops Research Network project. Analysis of availability of such savings will be done as soon as possible. The SC and other network members are encouraged to identify other potential sources of support, including availability of savings from other IDRC-funded oilseeds-related projects.

IDRC has already requested Professor Amram Ashri to help with the transition period, and he has expressed his willingness to do so. He has experience with proposal writing and with the requirements donors have for proposals. Professor Ashri will act as immediate contact and liaison person on behalf of IDRC, and he is prepared to receive status reports from the regional convenors identified at the Steering Committee meeting. He will give the reports careful study and provide guiding feedback on how to improve their content and presentation so that firm, credible, and salable proposals for networking can finally emerge. He may be able to advise on potential donors in addition to those that the convenors have identified in consultation in their respective regions by telex/fax. (Professor Ashri's contact address: The Hebrew University of Jerusalem, Faculty of Agriculture, P. O. Box 12, Rehovot 76100, Israel. Tel.: 972-8-481209; Fax: 972-8-468265; Telex: 381331 HUAGR IL.)

Also with the help of Professor Ashri, IDRC shall explore whether ICARDA is interested in starting and sustaining a modest newsletter about oilcrops issues, to be mailed to people on the present Oilcrops Research Network mailing list. The newsletter would focus on news, events, activities. It would not present full proceedings or research papers, for which authors will have to find a new outlet.

IDRC is sending the summary proceedings from the workshop, Professor Ashri's workshop highlights report, and a version of this document to all workshop participants, institutional leaders facilitated by the Steering Committee and to donors.

As part of the continuing PCSR focus on the oilcrops sector in Eastern and Southern Africa, IDRC will take a more active role in the ORN transition activities in this region, networking VOPS Kenya and AGREF's partnership with Tanzania and Zambia with programmes of other countries in the region. This will include continued discussions about information needs by researchers, policy makers, and resource allocators in the sector. It is to be hoped that information networking activity will be initiated to serve the information needs of relevant personnel, not only in this region but in others.

Further Suggestions for the Transition Process

The status reports should identify region-specific needs, strengths, resources, and opportunities; the region's needs for knowledge and information; the disciplines and institutions within which networking should take place; and the best forms of collaboration. A related problem is, Do the convenors or regional members have information in addition to that presented in Ken Riley's analysis of the three regions?

The consultation process should consider whether the PCSR approach is the only one that should be considered. What is the extent of each country's interest in a multidisciplinary approach aimed at improving the performance of national oilcrops subsectors? Are there other preferred strategies of expanding researcher awareness, starting with the existing linked breeding and agronomy disciplines? How can strong national programmes reach out to weaker ones? Where regional priorities are breeding and agronomy, it seems most useful to actively link researchers with the emerging International Board for Plant Genetic Resources (IBPGR)[1] crop germplasm networks as a way of achieving continuity. It is expected that these networks, emphasizing the utilization of germplasm, which is of particular interest to members of the current ORN, should be able to fill the vacuum left by IDRC's resource reduction.

Members of the Steering Committee and the convenors should use this transitional opportunity to explore how nationally available internal or external resources (such as existing IDRC-funded oilseeds-related projects or other donor-funded national oilseeds

[1]Now the International Plant Genetic Resources Institute (IPGRI).

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activities) can be used in the interest of the regions to defray any extra costs of the consultation process and modest followup.